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VISUAL TESTS OF FATIGUE IN OPERATIONAL FLYING

BY

D. D. REID

From the London School of Hygiene and Tropical Medicine, University of London, and lately of the Directorate-General of Medical Services, Royal Air Force

The recurring problems in the medical supervision of men engaged in operational flying in the Royal Air Force were the optimum length of the tour of duty to be expected of them and the detection of the point in that tour of duty when an individual was showing signs of impending breakdown. The length of the tour of duty had to be laid down as a general rule for each type of operational duty—whether fighter, bomber, coastal command, etc.—and set at a level which obtained for the Service an adequate operational return for the training investment made and yet was compatible with the maintenance of health and morale. Within the broad guide of this general tour limit, some latitude had to be allowed for individual variation. Breakdown in any individual may be the result of some particularly harassing experience or the cumulative effect of stress on a man of less robust nervous constitution. The release of a flying man from operational duty should anticipate complete breakdown but, if group morale is to be maintained, relief should not follow the appearance of slight deviations from normal function. Few men survived an operational tour without showing some evidence of the effect of stress, whether symptomatic or objective, and it would have been unfair to relieve only those who brought these complaints to the squadron medical officer. Occasions arose, too, where the squadron doctor was asked to state whether a man who was suspected, if not of malingering, at least of magnifying the physical and mental disturbances inevitable in air warfare did in fact show objective signs of undue physical reaction to the operational environment. The distinction between the normal (in the sense of usual) reaction to strain and abnormal reactions which might portend neurotic illness was necessarily a fine one, and the appreciation of lesser degrees of abnormality presupposed a precise knowledge of the limits of normal variability round the average. Upon such knowledge rested many of the hopes that medical supervision could make a useful contribution to the prevention by anticipation of psychological disorder in flying crews.

A considerable body of experience of the characteristic patterns of symptoms, behaviour, and operational performance was obtained in the various Commands of the R.A.F. (Symonds and Williams, 1947). During most of the war, however, little information was available about the objective physical measures of stress either as a group or individual phenomenon. Given such physical measures, it should be possible to make a quantitative assessment of the effects of stress in a homogeneous group of flying men, e.g. night-fighter pilots, and to determine whether, for example, there was a critical point in the prevailing length of tour of duty expected of them beyond which a consistent deterioration set in. Again, if the individual variability round the general trend of the physical index used could be measured, the significance of an individual's aberrant reaction could be readily assessed in terms of this index.

Some work done on this subject has already been reported (Reid, 1947). Weighing a large group of men engaged in night bomber operations at one point in time demonstrated that, compared with those who had not started their operational tour, men who had done up to 12 bomber sorties showed a drop in weight of about 2 lb. After the twelfth sortie, stabilization took place and weight was maintained about that level in those who survived. That this drop in weight probably signified that fluctuation in body weight was objective physical evidence of the effects of stress was suggested by contemporary evidence of an increase in the incidence of psychological disorder and minor sickness during the first part of the tour and a fairly stable rate thereafter. This meant that in so far as these indicators were valid, there was no point within the general tour limit of 30 bomber sorties beyond which a consistent decline in health and morale appeared.

This approach involved the measurement, at one point in time, of different men at different stages in their operational tour. It had the practical advantage that it produced a useful answer relatively easily and quickly, since there was no need to follow a series of men over a tour lasting perhaps six to nine months. But there was no doubt that the alternative method of performing repeated measurements on the same individuals over a period of time was intrinsically more attractive. Despite the very considerable administrative difficulties involved, it had the advantages that it eliminated, by measuring the same man at different stages of his tour, the variation between individuals which might blur a trend in the index over a number of sorties. Again, although the first method was necessarily limited by the numbers involved to a crude measure such as bodyweight, the possibility of observing a small group of individuals permitted the use of more elaborate and thus perhaps more sensitive objective measures of physical deterioration.

It was decided, therefore, to look for rather more finely balanced physiological functions which might be expected to react sensitively to environmental stresses on the individual, yet which would be susceptible to reliable measurement. The importance of vision in flying and the special experience of the medical branch of the R.A.F. in applying tests of visual function made the choice of such tests appropriate. The Consultants in Neuropsychiatry and Ophthalmology, Air Vice Marshals Sir Charles Symonds and P. C. Livingston, therefore agreed to initiate a field trial of tests of visual function as a physical measure of the effects of operational stress in night bomber crews.

Outline of Method

The special tests of visual function selected for study were, with one exception, those used routinely in the selection of men for flying duties in the R.A.F. The technique of measurement in each case is described in full in the Air Ministry publication "Medical Examination for Fitness for Flying" (1941). Tests of visual acuity were included in the survey, but the main emphasis lay on tests of visual judgment or of ocular balance. The function of accommodation in particular was thought to be most liable to upset by general strain. All the tests available for the detection of ocular muscle imbalance were used, and a test of physiological diplopia, then being developed by Livingston, was added. The final selection thus included

Bishop Harman Diaphragm Test.—This is designed to estimate "the desire for binocular vision." This is a dissociation test where an adjustment is made for inter-pupillary distance and the degree of exophoria or esophoria indicated on a scale calibrated from 0 to over 8.

Maddox Wing Test.—This is likewise a dissociation test of ocular poise where the esophoria or exophoria is recorded in terms of dioptres.

Binocular Gauge Test.—This is a test of accommodation where the distance from the eye at which convergence on accommodation is seen to break down is measured in centimetres for each eye separately.

Experimental Test of Physiological Diplopia.—This was designed to estimate the degree to which this function was affected by continued operational strain. In this instance, the results were expressed in degrees.

All these tests were applied in a rigidly standardized fashion throughout the experiment by the same orthoptist (Section Officer J. Norman, W.A.A.F.). Before the field trials began, repeated assessments were made on the same individuals at intervals of some days to gauge the reliability of the measures used. These preliminary trials proved satisfactory and the field studies were started at a base from which were operating a squadron of Mosquito aircraft (carrying a pilot and navigator only) and a squadron of Lancaster aircraft carrying the usual crew of seven. Both squadrons belonged to the Pathfinder Force of Bomber Command and to that extent were selected from the main body of the heavy night bomber force. The operational role of the two squadrons differed slightly, but in general they both shared the environmental conditions prevailing in Bomber Command of the R.A.F. during the intensive efforts of 1944.

At the outset of the field study, all available operational crews were examined at rest during the day. The results of this examination then formed the base line from which subsequent deviations could be measured. At the same time, the individual's operational experience, counted in the number of sorties performed to date, was recorded together with his crew duty and his level of day visual acuity.

At intervals during the remainder of their tour these men were examined on their return from an operational sortie. Their experience (in sorties) at each examination, and the details of the weather, height, range, and opposition met with during that particular sortie, were noted. As fresh replacements arrived for the squadrons, they too were included in the survey.

After some months there thus became available a series of measurements on the same individual at

different stages in his operational tour. The average value for each of the measures proposed could then be worked out for each stage, 0, 1-5, 6-10 sorties, etc., and the general trend compared with previous results in this field. A review of the variation between the duration of individual sorties showed that it was too small to make possible any useful comparison between visual changes after sorties differing in duration or type. Attention was therefore mainly given to the behaviour, within a group, of visual function as a response to stress and to the deviation of an individual at different stages throughout the tour both from his own and from the group norm.

Summary of Results

From the data available, one reading for each type of measurement for each individual was taken at the nearest point to the later limit of the experience grouping, 1-5, 6-10, 11-15, 16-20, 21-30 sorties. At this point, it was assumed, the effect of cumulative stress between, say, the sixth and tenth sortie would have been at a maximum. If no significant trends were visible using this material, then it was unlikely that any other method of selection, e.g. taking the median observation within the experience group, would have produced significant findings.

Accommodation.—Accommodation fatigue has long been considered a prominent sign of general fatigue. Taking this visual function first, then, we can set out the results of the Binocular Gauge Test of accommodation as in Table I. The differences between the results given by right and left eyes are negligible (in fact the correlation between them is $r=0{\cdot}9044$, $n=100$, $P<0{\cdot}01$) and the two readings have been combined to give the mean accommodation averaged in each section of the operational tour in Table I.

The trend seen in the "total" row is fairly consistently evident in each of the various types of crew duty in both squadrons. In the Lancaster squadron, the level at which objective failure in accommodation occurs rises to a peak about the tenth sortie and remains fairly stable at that level during the remainder of the tour. This trend, which is suggestive of an initial period of adaptation to stress followed by a period of stabilization, is very similar to the trend in weight loss and in the incidence of psychological disorder already noted. It seems reasonable to suppose that all three measures indicate the group reaction in a heavy night bomber formation to a tour of duties of 30 operational sorties.

On the other hand, although the basic trend of

TABLE I

Mean Accommodation Scores (R. and L.) at Different Stages of Tour

Squadron	Resting		Stage in Tour									
			1–5		6–10		11–15		16–20		21–30	
	No.	Score	No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
Lancaster												
Pilot	10	8·85	10	9·95	10	11·88	7	10·76	5	10·80	4	10·75
Navigator	12	9·33	12	11·70	12	12·74	7	12·46	5	11·75	2	11·33
Air bomber ..	11	9·05	11	10·95	11	10·40	9	10·67	6	10·41	4	11·85
Wireless operator ..	8	9·28	8	10·67	7	11·26	4	10·75	5	10·64	2	9·15
Flight engineer ..	5	9·20	5	11·52	5	11·50	5	12·35	5	11·92	3	11·40
Air gunner ..	19	9·21	19	10·38	18	10·22	12	11·16	10	11·07	5	11·74
Total	65	9·13	65	10·78	63	11·20	44	11·30	36	11·06	20	11·21
Standard deviation		2·09		2·02		2·21		2·73		2·78		2·03
Mosquito												
Pilot	18	10·05	10	10·44	13	10·98	14	11·58	12	11·76	10	12·02
Navigator	18	9·11	10	10·99	13	10·80	13	10·50	12	11·49	10	12·97
Total	36	9·58	20	10·72	26	10·89	27	11·06	24	11·63	20	12·49
Standard deviation		2·50		1·79		1·77		2·12		2·08		2·64

adaptation also appears in the results for the Mosquito squadron, there is a suggestion of a terminal rise which might indicate a physical deterioration resulting from excessive stress associated with the squadron's rather different role. For several reasons such questions can hardly be answered by the data in their present form. The application of tests of significance for the trends observed is complicated by the fact that, owing to attrition and replacement, the population examined differs from stage to stage. Some of the men will be represented at each stage, others only at some stages, so that not only are the mean scores at different stages not independent of each other, but also some of the differences observed may be the result of differences between individuals rather than the true result of changing adaptation to stress. Further, it is possible that men with subnormal powers of accommodation may be inefficient, e.g. in piloting and gunnery, and therefore less likely to survive a tour. Such a relationship would tend to lower the average level of accommodation by the selective elimination in action of those with adverse (i.e. high) scores in the Binocular Gauge Test. The possibility of a masking of the results must be considered and the evidence for such a supposition is set out in Table II. In this table are given the members surviving beyond their twentieth sortie among groups achieving good or poor scores in a test applied before the beginning of their tour of operational duty. Although the differences are suggestive, the combination of the uncorrected χ^2 values for the two tables gives a value of $\chi^2=4{\cdot}053$, with $0{\cdot}20>P>0{\cdot}10$ for $n=2$, so that it is unlikely that selective elimination is a serious source of error in the analysis.

It is easy to show that, as in Table III, there is a significant increase in Gauge Test score, i.e. a lessening in efficiency of accommodation, after the first operational sortie over the resting level measured before the tour starts. This means that, even in the short term context before the cumulative stress of the operational tour has begun to take effect, the Gauge Test of accommodation is a useful indicator of reaction to the operational task.

TABLE II

INITIAL ACCOMMODATION SCORE AND SURVIVAL IN OPERATIONS

Gauge Score	Total	Survived	Not Survived	Survived (%)
Lancaster Squadron				
Good (7-8·5)	15	10	5	67
Poor (9-)	21	10	11	48
$\chi^2=0{\cdot}6300$, $n=1$, $0{\cdot}50>P>0{\cdot}30$				
Mosquito Squadron				
Good (7-8·5)	29	12	17	41
Poor (9-)	36	8	28	22
$\chi^2=1{\cdot}9409$, $n=1$, $0{\cdot}20>P>0{\cdot}10$				

TABLE III

GAUGE TEST SCORES BEFORE AND AFTER FIRST OPERATIONAL SORTIE

Lancaster Squadron* Crew Duty	No.	Mean Score (R. & L. eyes) Before	After
Pilot	10	8·85	9·85
Navigator	12	9·33	11·29
Air bomber	11	9·05	10·64
Wireless operator	8	9·28	10·47
Flight engineer	5	9·20	10·60
Air gunner	19	9·21	10·50
Total	65	9·16	10·58

* Difference=1·42, t=7·72 for n=64, $P<0{\cdot}01$

Mosquito Squadron† Crew Duty	No.	Mean Score (R. & L. eyes) Before	After
Pilot	18	11·06	10·75
Navigator	18	9·11	10·86
Total	36	9·58	10·80

† Difference=1·22, t=3·41 for n=35, $P<0{\cdot}01$

For the reasons given above, however, it is less easy to measure the significance of the long-term trends apparent in Table I. The difficulties of non-independence can be overcome by taking from the accumulated records the results at or near 0, 5, 15, 20 and 25 sorties in individuals who survived the tour and were examined regularly throughout it. The use of recordings made on the same individuals at regular intervals during the tour simplifies the application of analysis of variance technique to the study of the stage-to-stage trends. The data are set out in full in the appendix (page 109), but

TABLE IV

MEAN ACCOMMODATION AT SUCCESSIVE STAGES IN TOUR

Squadron	No.	Stage in Tour					
		0	5	10	15	20	25
Lancaster	19	8·74	9·92	11·37	10·82	10·95	11·66
Mosquito	6	8·00	11·25	10·17	11·42	11·42	12·00
Total	25	8·56	10·24	11·08	10·96	11·06	11·74
Standard deviation		1·872	2·001	2·853	2·861	2·438	2·611

Table IV gives the means at each stage in each squadron together with the standard deviation of the total observations at each stage.

Comparing these results with those in Table I, it is clear that the same general trends arise; yet in this instance a terminal change appears in the last stage of the tour in both squadrons. The numbers are rather small, so that it is probably safer to use the whole of the data provided by the repeated measurements on all 25 individuals.

Looking first at the variability of the observations at successive stages, there is a hint that the variability increases with progress through the tour to reach a maximum about the fifteenth sortie. Application of Bartlett's test for the differences between variances, however, shows that they could well have arisen by chance ($0{\cdot}20 > P > 0{\cdot}10$). On this basis, homogeneity of variance over the series of arrays can be fairly safely assumed and analysis of variance carried out. The results of that analysis appear in Table V.

From the analysis of Table V it is clear that, since the " between-stage " mean square is significantly greater than the " error " mean square given by the within-stage residual variance, real differences in mean accommodation score exist at different stages of the operational tour. These differences follow a trend which, as the splitting up of the " between-stage " sum of squares shows, could be best described by fitting a curved regression line of a cubic type. Such a curve was in fact fitted to the data by Fisher's method of using orthogonal polynomials and the closeness of the fit to the means is seen in Fig. 1. This method of fitting a curve to describe each significant feature of the data permits fairly confident interpretation. Clearly, there is a real, in the sense of technically significant, rise in the mean accommodation score in the Binocular Gauge Test during the period of adaptation to operational stress. Between the tenth and the fifteenth sortie, stabilization takes place, but, in the last part of the tour, there is clear evidence of a deterioration in the power of accommodation. In this last respect the present result differs from the

TABLE V

ANALYSIS OF VARIANCE OF MEAN GAUGE SCORE

Source	Sum of Squares	D.F.	Mean Square	F.
Linear term	118·8206	1	118·8206	49·55*
Quadratic	18·8576	1	18·8576	7·86*
Cubic	15·7236	1	15·7236	6·56†
Between stage residual	0·6515	2	0·3253	<1
Between stages	154·0533	5	30·8107	12·85*
Between individuals	590·9600	24	24·6233	10·27*
Within stage residual	287·7800	120	2·3982	
Total	1,032·7933	149		

* Highly significant $P < 0{\cdot}01$ † Significant $P < 0{\cdot}05$

findings for the other indices of the effects of strain, such as weight loss, used in previous studies on the health of Bomber Command as a whole. In part this may be the result of excessive stress on the Pathfinder Force from which the two squadrons were drawn; but it may equally be an indication of the sensitivity of the method now being discussed.

There is one last point of importance in this context. The 25 individuals whose records have been thus analysed all survived an operational tour. Their response to strain therefore represents the reaction of a sample of the whole crew population of particular quality. Taking their experience as a model of "normality" in response to the stress of bomber operations, it should be possible to lay down "control limits" outlining the likely range of individual deviations from a standard expectation based on this response curve.

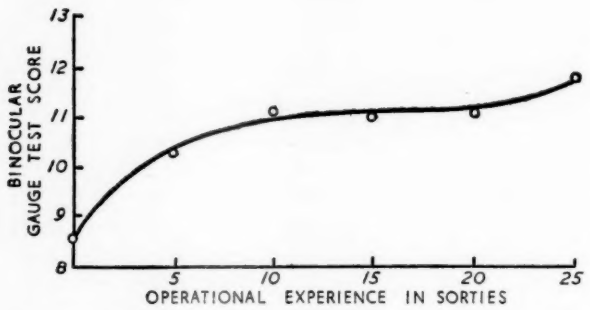

FIG. 1. Trend in accommodation test results during operational tour.

might be said that only one in twenty individuals of a group measured at the same stage in their tour will have a score differing by more than $2 \times 2 \cdot 5 = 5$ units from the group mean at that stage.

These limits can be minimized and thus made more useful by eliminating this variability between individuals. This can be done by relating an individual's score at each stage to the resting score of that individual before starting the operational tour, i.e. the score at any stage is expressed as a deviation from the base line of the resting score. The expected "normal" upward trend from this base line is given by the curve fitted to the means starting from the resting score. Round this expectation there will be, at all stages, a variation

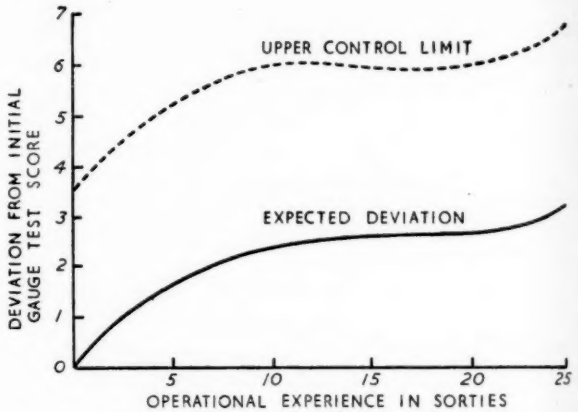

FIG. 2. Control limit of accommodation scores during operational tour.

The variation between individuals is, of course, considerable. At any particular stage in the tour the accommodation scores for a series of individuals will vary about the point on the curve appropriate to that stage in the tour with a variance which can be estimated from Table V. The difference between the "between-individual" mean square and the "within-stage" mean square (22·2251) is due to the variance between individual levels which can be estimated by dividing 22·2251 by 6, the number of stages upon which it is based. To this result (3·7041) must be added the final residual variance which is a measure of the variability in the scores of any one individual round his own mean score at any one point in the curve tour (2·3982). The resulting variance estimate (6·1023) gives a standard deviation of $\sqrt{6 \cdot 1023} = 2 \cdot 47$ for the variation of the scores for a series of individuals round the mean appropriate to some fixed stage in the tour. Assuming normality of distribution and taking the limit o the nearest point of the measuring scale (2·5) it in score for the same individual of a size indicated by the "within-stage" variability of Table V (2·398). This variance will apply to both initial and subsequent measurements so that the significance of the difference between them must be assessed in terms of the standard error of that difference which is derived from the sum of their variances: $\sqrt{2 \times 2 \cdot 398} = 2 \cdot 19$.

This value of 2·19 units is a guide to the variability likely to be found round the expected difference between the initial observed resting score and measurements made at subsequent stages of the tour. Certainly such an estimate of variability is at best an estimate which is least accurate at the extremes of the operational experience scale, but within this range of experience it does give an adequate indication of the limits of "normal" variability in the differences between resting and subsequent scores. Control limits, based on this estimate of variability, can thus be laid down so as to include all but any desired proportion of the

scores. An upper limit set at 3·6 units above the expected difference for each stage in the tour, for example, as in Fig. 2, where 3·6=normal deviate for 95 per cent. (1·65)×standard deviation (2·19), will include all but 5 per cent. of the scores likely to be observed in a " normal " group of individuals. Only if an individual's score at any point in his tour is above the " upper control limit " appropriate to that stage could it be suggested that his reaction to stress was definitely unusual or significant. Whether such an unusual physical reaction is necessarily predictive or indicative of illness cannot, of course, be determined from the present data, but such a deviation from expectation certainly suggests that his resilience under strain is suspect and that particular care must be taken in his medical supervision.

Ocular Balance.—The results of the tests of ocular balance used (the Maddox Wing and the Bishop Harman Diaphragm tests) were obtained for the same 25 individuals for whom records were available throughout the tour. The unusual metric used in these tests makes any sophisticated analysis quite unrealistic. It is difficult, for example, to give numerical meaning to a shift from exophoria of two degrees to an esophoria of one degree, and it is probably adequate merely to note the changes in distribution with increasing experience in a group of flying men. This is done in Tables VI and VII where, for the same 25 men, are given the distributions of the results of Maddox Wing and Bishop Harman Diaphragm tests applied at different stages of the tour. In the first case, the χ^2 test would suggest that the changes in distribution differ insignificantly from stage to stage. This test, however, takes no account of trend and there is some indication that there is a decrease in the proportion of esophoric readings after the tenth sorties. This change is so slight, however, that it seems unlikely to have much practical value in this context. Similarly, however, the scores of the second test were divided up, the resulting distributions were remarkable only in their stability, and statistical tests are superfluous. It would appear, then, that neither of these two tests gives the same promise as a measure of the response to stress as does the gauge test of accommodation.

TABLE VI

DISTRIBUTION OF MADDOX WING TEST SCORES THROUGHOUT TOUR

	Stage in Tour					
	0	1	5	10	15	25
Considerable esophoria (6+)	15	15	14	10	11	11
Remainder	10	10	11	15	14	14

$\chi^2=4·1904$, n=5, $0·70>P>0·50$

TABLE VII

DISTRIBUTION OF BISHOP HARMAN DIAPHRAGM TEST SCORES THROUGHOUT TOUR

	Stage in Tour					
	0	1	5	10	15	25
Esophoria (1–)	5	6	5	4	5	2
Remainder	20	19	20	21	20	23

Physiological Diplopia.—The average values found by using the test of physiological diplopia at each stage in the tour are given in Table VIII where the observations are expressed in terms of the deviation from the resting value. It is clear that, although there are differences in a negative direction between the resting value and the score made on test on

TABLE VIII

MEAN DEVIATION FROM RESTING RESULT IN DIPLOPIA TEST THROUGHOUT TOUR

Squadron	Stage in Tour											
	1–5		6–10		11–15		16–20		21–25		26–30	
	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean
Lancaster . .	56	+0·1607	64	−0·8438	44	−0·5455	36	−2·7222*	20	−0·9500	15	−3·4000*
Mosquito . .	20	−0·2500	26	−0·5385	26	−0·2692	24	−0·7083	20	−1·0000	12	+1·0000

* " t " test gives a probability of $<0·01$ in these instances.

return from a sortie, these differences reach significant levels on only two occasions. Further, there is no consistent trend between the mean values at different stages of the tour at all comparable with the trend seen in accommodation and the other physical indicators of the effect of stress. For these reasons, it seems fairly certain that this test, at least in its present form, is not of value in the detection of either short-term or cumulative fatigue.

Discussion

A review of these results suggests that in tests of accommodation we have a sensitive, accurate indicator of the reaction of individuals to a harassing environment. The use of a sensitive test in repeated examination of the same individual during a period of strain gives the same indications as do cruder measures, such as loss in bodyweight, when assessed in different individuals at different stages in their tour. It is also clear that the tests of ocular poise and of physiological diplopia give no such promise.

In the supervision of the health of flying men, the indications of terminal deterioration appearing in this study may be useful in determining the optimum limits of the operational tour. As has been shown, however, individual differences are considerable but, if each individual's performance on test can be related to his own resting level before the period of stress began, the general experience of the group to which he belongs can be used as a guide to the reaction likely to be observed. The deviation of an individual's score from that expectation must be assessed in terms of the usual variability likely to be found between repeated observations, and this variability can be readily estimated.

The possibility of using similar techniques in the study of short and long-term fatigue in industry should be considered. Admittedly the physical changes noted in this survey have been the result of a stress of particular intensity. But they have arisen in men of exceptional calibre. The less dramatic strains in industry operate on a much less highly selected population, and with large numbers and more sensitive tests useful indications of group reaction to environment may be obtained.

Summary and Conclusions

A statistical analysis has been made of the results of a survey of the effects of operational flying stress on the visual function of men of two bomber squadrons of the R.A.F. during the later stages of World War II. It is suggested that tests of accommodation were sensitive indicators of the reactions of men to the exceptional stress of their environment at that time.

Such tests, repeated on the same individuals at intervals throughout the tour, gave substantially the same indications as did the trend of weight differences between a large series of different men measured at different stages in the tour. In both instances there was evidence of a period of adaptation to stress when mean weight fell and the power of accommodation deteriorated, but then, after about the tenth sortie in a tour limited to 30 sorties, stabilization at a new level took place. Confirmation of this interpretation comes from similar trends in the incidence of psychological disorder at different stages in the tour.

The use of a test of accommodative power had additional advantages: it seems to be able to discriminate in a fairly objective fashion between resting performance and performance in the fatigue state on completion of a sortie. More important, however, is the suggestion that by the repeated use of sensitive tests on the same individuals, it might be possible to detect long-term trends in cumulative fatigue. The value of such indications in laying down optimum limits of duration of operational employment is discussed and suggestions are made for the use of the estimates of variation in an individual's performance from time to time to estimate the significance of his deviation from the average performance of a group subject to the same cumulative strain.

The more precise methods of supervision of health suggested in this study may have a wider application in occupational medicine.

Similar study of tests of ocular poise and physiological diplopia gave no clear promise of usefulness in this field.

I am indebted to Sir Charles Symonds and Professor A. Bradford Hill, Consultants to the Royal Air Force in Neuropsychiatry and Medical Statistics, for their advice, and to the Director-General of Medical Services of the Royal Air Force, Air Vice Marshal P. C. Livingston, both for his help while Consultant in Ophthalmology and for permission to publish this report. To Mrs. K. M. Bull, Miss B. M. Miller, and Miss O. M. Penfold I am obliged for their clerical and computing assistance, and to Mrs. M. G. Young for drawing the diagrams.

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APPENDIX

Binocular Gauge Test Score at different Stages in Tour

Squadron	Stage in Tour in Sorties					
	0	5	10	15	20	25
Lancaster						
Pilot	9	12	11	10	10·5	12·5
	8	9	7	9	13	11
	7	10	13	11	12	12
	7	8	8·5	11	8	9
Navigator	9	11	13	11	11	12
	7	8	11	8·5	9	10
Air bomber	10·5	14·5	12	12	10	13
	9	9·5	13	10	12	12
	8	9	10·5	10·5	12	12
Wireless operator	7	10	9·5	7	8	9
	8	9·5	10	—*	10	10
Flight engineer	12	12	16	17	13	17
	8	9	8	11	10	10
	7	11	11	8·5	10	9
Air gunner	12	9·5	19·5	19·5	19·5	19
	8	8	11	8	10	11
	7	8	8·5	9·5	9	9
	15·5	12·5	15·5	13	11	14
	7	8	8	8	10	10
Mosquito						
Pilot	9·5	10	11	11·5	11	11
	8	10	9	9	10	10
	7	10·5	10	11	10	13
Navigator	9·5	12·5	8	9	9	9
	7	15·5	12	14	14·5	16
	7	9	11	14	14	13

* Value estimated by " missing plot " technique was used in analysis.

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THE CARE OF THE CHRONIC SICK

I. MEDICAL AND NURSING REQUIREMENTS*

BY

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INTRODUCTION

If we are not now aware that old age and chronic sickness are among the most urgent of contemporary medical problems, it is not the fault of the numerous writers who have tried to persuade us. Their case is supported by national statistics, and stated briefly amounts to this: the fact that preventive medicine (to use the term in its most inclusive sense) has reduced the incidence of disease in younger age groups means that a higher proportion of the general population suffers from the diseases of old age; the relative contribution of these diseases to the total incidence of disease is already high and is increasing; we are comparatively ignorant about the diseases of late life and have the best of reasons for learning more about them (in this matter we have the double interest of the actuary and of the insured).

In this paper, the first of a series based on an investigation of the chronic sick in hospital, we deal mainly with administrative difficulties created by these diseases. It will be useful first to consider the reasons which have led to the coupling of the problem of chronic sickness with that of old age, for if we use the term chronic sickness in reference to diseases which continue or recur over a considerable period, it is quite evident that it is not limited to late life. Bronchitis, rheumatic heart disease, and disseminated sclerosis are examples, in the respiratory, circulatory, and nervous systems respectively, of chronic diseases which commonly appear for the first time in young people. The fact that we associate chronic sickness with old age reflects a natural preoccupation with the administrative problem. As scientists we should like to know the proportion of the chronic diseases which first appear in each age group, but as medical administrators we are more concerned with the proportion of individuals in each age group who require attention.

It is known that most patients who need continuous care are old, but there is no detailed information about the kind of care they require. The only substantial numerical data are based on returns of hospitals for the chronic sick, and give the total population in hospital; these figures have also been subdivided into "chronic sick" and "aged and infirm"†, but the division tells us nothing of the medical and nursing requirements of patients in each group. We have only to recall the way in which cases were admitted until July, 1948, to recognize the mixed nature of this hospital population. The medical needs of the elderly patient cannot be considered apart from the social circumstances in which they arise, and the general practitioner who stated to the relieving officer that in his opinion a patient should be admitted to hospital was inevitably influenced by the inadequacy of facilities in the home, as well as by the urgency of the need for hospital treatment. Even more important, as we shall show in a later paper, it has frequently been necessary to retain in hospital patients whose need for frequent medical attention or skilled nursing was transient, but whose home circumstances prevented discharge.

This was a situation which the Poor Law authorities could accept with composure. They were responsible for the social as well as for the medical needs of many of their patients, and the vicarious burden on their hospitals was compensated by relief for other parts of their administration. Indeed, having regard to the limited staff and equipment used in the hospitals it was even possible that an elderly patient not requiring medical attention or skilled nursing could be provided for as economically in a hospital bed as elsewhere.

There was no important change during the period of administration under local authorities (1929-1948),

* This research was assisted by a grant from the Birmingham University Students' Social Services Fund.

† Report of the Working Party on the Recruitment and Training of Nurses, p. 107.

and the hospitals transferred in July, 1948, to regional hospital boards still housed deprived children, the aged and infirm, and the destitute of all ages, as well as the chronic sick. But the responsibility of the new authorities was limited sharply by act of parliament to hospital care, and, faced with the unpleasant facts of long waiting lists and too few beds, they naturally viewed with concern the possibility that their hospitals contained patients who could be cared for more economically elsewhere, and who were in any case not their problem.

The reasons for concern about this situation are not all administrative ones. We know that the social and medical attention which patients later require are determined to some extent by the adequacy of the services to which they have access in the acute stages of their illness. Continence and mobility in particular reflect the standard of care received. The fact that hospital beds are scarce, and likely to remain so for some time to come, makes it important that they should not be occupied by patients who no longer need hospital attention.

We have attempted in this paper to answer two questions. (1) What proportion of the chronic sick require the kind of medical or nursing attention provided in hospitals? (2) What facilities are needed for patients who can more satisfactorily or more economically be cared for outside hospitals?

For this purpose it has been necessary first to define the nursing and medical attention which justify hospital care, and second to examine the requirements of patients in relation to these standards.

Material and Methods

The numerical data in this paper are derived from an analysis of 1,005 patients in Western Road Infirmary, Birmingham. A brief account follows of the nature of this material and of the extent to which it may be regarded as representative of the problem of chronic sickness in the country as a whole.

Western Road Infirmary is typical of many institutions provided as workhouses under the Poor Law Amendment Act of 1834 and administered by a Board of Guardians elected locally to serve the surrounding parishes. To the original workhouse, now more than a hundred years old, was added during the nineteenth and twentieth centuries a series of hospital blocks for the sick and infirm destitute. These are badly planned buildings, with high windows, narrow ward doors, and totally inadequate kitchens and sanitary arrangements, designed with an eye on the cost to local rates rather than on the convenience of patients and staff. Under the Local Government Act of 1929 this building came under the control of the Public Assistance Committee of the Birmingham City Council, and on July 5, 1948, the hospital wards were transferred to the Regional Hospital Board. The old workhouse, consisting of 299 beds for the poor and destitute, has been taken over by the local authority's social welfare committee complying with the National Assistance Act of 1948.

The occupants of these 299 beds, and of 155 beds used for venereal and skin diseases, are excluded from the survey, which covers only the 1,005 patients classified by the Chief Medical Officer as "chronic sick". The beds used for these various purposes are to some extent interchangeable, and the numbers vary slightly from time to time.

After a preliminary survey of 50 patients, a record card was designed for hand sorting. It was divided into two parts: a medical section, completed by one of three doctors; and a social section, completed by one of two social workers. Records were inspected on completion, and returned for attention to inconsistencies or omissions. The staff engaged on this work were married women with some domestic responsibilities, who gave part-time service under the supervision of one of us (C.R.L.). This arrangement, necessary because of the difficulty of recruiting doctors and social workers for full-time service for a limited period, was entirely satisfactory in an enquiry in which the exacting nature of the work made full-time employment undesirable.

The data are mainly the results of physical examinations and of histories taken from the patients. Where the latter sources were not available (20 per cent. of patients were grossly abnormal mentally, and 4 per cent. were deaf) or were considered unreliable, relatives were interviewed on visiting days. No home visits were made, and where data in respect of domestic circumstances could not be obtained from patients or relatives the items were entered as "unknown". Much of the medical data was provided or confirmed by the ward doctor or sister, and records of mental state, mobility, and bladder and bowel habits, were completed only after consultation with them. The hospital records, though adequate for the needs of the hospital staff, were of little use for research purposes. The medical diagnosis and details of laboratory investigations were extracted, but no other use was made of this source.

We have no reason to believe that the population of Western Road Infirmary differs in any important respect from that of other hospitals of the same type; at a later date we can make a comparison with the hospitals in the Stoke-on-Trent area where

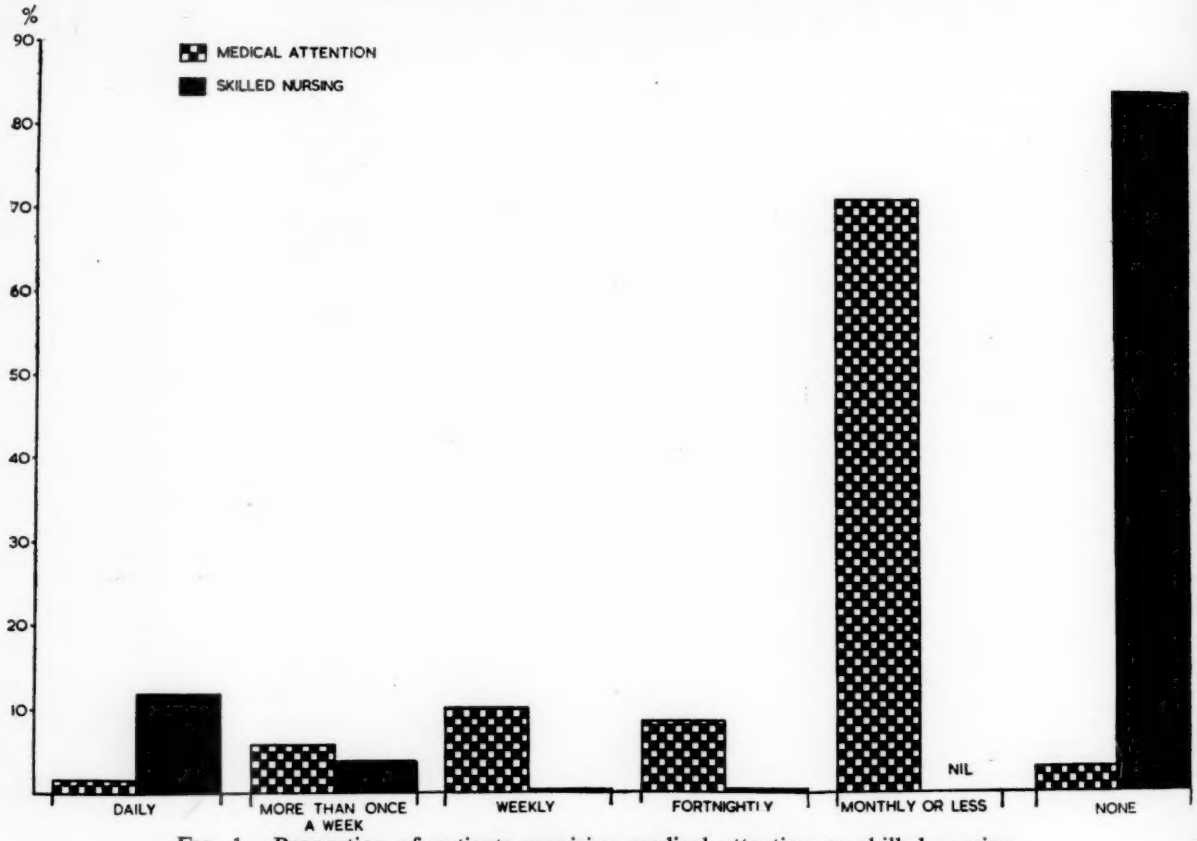

FIG. 1.—Proportion of patients requiring medical attention or skilled nursing (see Tables I and II).

the same material has been collected. It will be evident that we have no information about patients with chronic diseases cared for in mental, general, or other hospitals, or in their own homes, who are also excluded from the recent national returns, one of which* gives 70,000 as the number of chronic sick in England and Wales. Of this total, the 1,005 patients in the survey represent about 1·4 per cent.

MEDICAL AND NURSING REQUIREMENTS

Our examination of the medical and nursing requirements of each patient is based upon a distinction between four different types of service: (i) medical attention, (ii) skilled nursing, (iii) simple nursing, and (iv) domestic service.

(i) *Medical Attention.*—In assessing medical attention needed by patients, we have had regard both to the attention actually received in hospital and to that which the patient's condition appeared to merit. In Western Road Infirmary, in conformity with usual hospital practice, every ward is visited daily, and medical supervision given if required. Needless to say, this frequent attention is in many cases quite unnecessary, and for our records the appropriate interval has been decided in each case after careful consideration of the patient's condition.

The results of this examination are contained in Table I (see also Fig. 1), which may be summarized in the statement that although nearly all patients (97 per cent.) require medical attention, few of them (7 per cent.) need it more frequently than once a week, and only about a quarter more frequently than once a month.

(ii) *Skilled Nursing.*—The distinction which we have considered it imperative to make between skilled and simple nursing is not a usual one. The duties of the State Registered Nurse are not as a rule limited to those in which training and skill are required, nor is the work of the assistant nurse restricted to what is described below as simple nursing. But it is only by making this arbitrary division that we can assess even roughly the nursing requirements of each patient, and we therefore include under skilled nursing only those duties, such as injections, dressings, administration of dangerous drugs, care of acutely ill people, etc., for which it may

* Report of the Ministry of Health for the year ended March 31, 1947.

TABLE I*

MEDICAL ATTENTION REQUIRED (see Fig. 1)

	Daily	More than once a week	Weekly	Fortnightly	Monthly or Less	None	Totals
Males ..	10 (2·2)	36 (7·9)	61 (13·4)	44 (9·7)	282 (62·0)	22 (4·8)	455 (100)
Females ..	6 (1·1)	22 (4·0)	42 (7·6)	41 (7·4)	431 (78·4)	8 (1·5)	550 (100)
All patients	16 (1·6)	58 (5·8)	103 (10·2)	85 (8·5)	713 (70·9)	30 (3·0)	1,005 (100)

* In all tables, percentages are given in brackets.

TABLE II

SKILLED NURSING REQUIRED (see Fig. 1)

	Daily	More than once a week	Weekly	Fortnightly	None	Totals
Males ..	65 (14·3)	24 (5·3)	2 (0·4)	1 (0·2)	363 (79·8)	455 (100)
Females ..	55 (10·0)	14 (2·5)	1 (0·2)	2 (0·4)	478 (86·9)	550 (100)
All patients	120 (11·9)	38 (3·8)	3 (0·3)	3 (0·3)	841 (83·7)	1,005 (100)

TABLE III

SIMPLE NURSING REQUIRED

	Required	Not Required	Totals
Males	414 (91·0)	41 (9·0)	455 (100)
Females	521 (94·7)	29 (5·3)	550 (100)
All patients ..	935 (93·1)	70 (6·9)	1,005 (100)

reasonably be claimed that full training is necessary.

Table II (see also Fig. 1) indicates that few patients (16 per cent.) require skilled nursing, but that those who do require it often. Twelve per cent. need daily the type of service referred to.

(iii) *Simple Nursing.*—With the problem of disposal in view, we have also thought it desirable to distinguish clearly between simple nursing and domestic service. Many patients need to be washed, fed, dressed, or lifted into and out of bed, tasks characterized by the personal nature of the service but not requiring skill of the kind referred to under (ii). We have been in doubt about the classification of patients who are incontinent of faeces or urine, but whose care would not otherwise necessitate the presence of a skilled nurse. These cases are considered to require simple nursing only, but since it may be argued that the prevention of bed sores is a service for which training and skill are needed, incontinent patients are shown separately in tables where a different decision might have a bearing on disposal. Table III shows that 93 per cent. of patients require simple nursing.

(iv) *Domestic Service.*—All patients in Western Road Infirmary need some form of domestic service (shopping, preparation of food, laundry, cleaning, etc.). This fact, which requires no further numerical examination, emerged from detailed consideration of individual needs, and has an important bearing on any plans for subsequent disposal.

DISPOSAL

The possible disposal of patients is now considered in relation to their medical and nursing requirements. It may be necessary to emphasize at once that it is not suggested that the arrangements proposed are available to hospital authorities at this time; beds in general and mental hospitals, for example, are already insufficient for their recognized commitments. All that is attempted is to guide future policy by indicating alternative facilities which the requirements of the present hospital population appear to warrant; we have naturally had in mind the importance of freeing hospital beds of all patients for whom satisfactory and more economical arrangements can be made elsewhere.

Table IV (overleaf; see also Fig. 2) gives the numbers of patients in each of the four main divisions identified as follows:

PATIENTS WITHOUT GROSS MENTAL CHANGE

(*a*) *Hospital* (one-fifth). Patients needing skilled nursing and/or medical attention once a week or more frequently are considered to require hospital care. Most patients in this group do, of course, need both skilled nursing and frequent medical attention, but cases needing one and not the other are also included. It may be objected that where no skilled nursing is required medical attention at weekly intervals should not be provided in hospital, but we have preferred to risk criticism of a conservative estimate.

(*b*) *Institution or own home* with *simple nursing* (slightly over half). Patients who do not require skilled nursing, or medical attention, as often as once a week are not considered to require hospital care if the necessary arrangements can be made in alternative institutions or in their own homes.

(*c*) *Institution or own home* without *simple nursing* (slightly under one-tenth). Patients in this group are distinguished from the previous one by the fact that they do not require the kind of personal service described as simple nursing.

TABLE IV

SUGGESTED DISPOSAL OF PATIENTS (see Fig. 2)

	Patients without Gross Mental Change			Patients with Gross Mental Change	Totals
		Institution or own home			
	Hospital* (*a*)	With simple nursing† (*b*)	Without simple nursing‡ (*c*)	Hospital§ (*d*)	
Continent	137	390	69	52	648
Incontinent (urine and/or faeces)	52	159	1	145	357
Totals ..	189 (18·8)	549 (54·6)	70 (7·0)	197 (19·6)	1,005 (100)

* Includes patients requiring skilled nursing, and/or medical attention, once a week or more frequently.

† Simple nursing: washing, dressing, feeding, lifting in and out of bed, etc.

‡ These patients all require some form of domestic service.

§ Includes all patients requiring supervision because of their abnormal mental state.

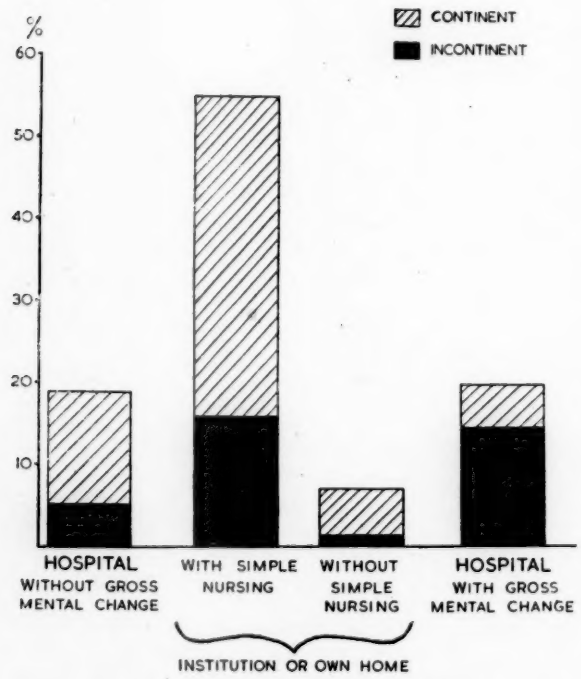

FIG. 2.—Suggested disposal of patients (see Table IV).

PATIENTS WITH GROSS MENTAL CHANGE

(*d*) *Hospital* (one-fifth). It has been thought necessary to consider separately the disposal of patients whose mental state is such that, irrespective of other medical and nursing requirements, they need personal supervision and must therefore, with few exceptions, be cared for in hospital. The group excludes some other patients (distributed between (*a*), (*b*) and (*c*)) who have mental changes of a kind not necessitating personal supervision, such as dullness, apathy, speech difficulty, or failing memory.

We next examine in detail the diagnosis, age, duration of stay in hospital, and mobility and continence of the patients in each of these four main divisions, considerations which have an important bearing on the acceptability of the classification suggested above.

(*a*) *Patients without Gross Mental Change, requiring Skilled Nursing and/or Frequent Medical Attention.*—Tables V and VI (opposite) give for males and females respectively the diagnosis and attention required by the patients in this group. Many of them are in the acute and some in the terminal stages of illness; almost all require the kind of attention (dressings, injections, investigations, care of acute illness) best provided in general hospitals.

It is mainly in respect of age and duration of stay that these patients differ from those ordinarily admitted to general hospitals (Tables VII and VIII overleaf; see also Figs. 3A and 4A); 88 per cent. are over 60; half have been in hospital for at least three months, and about one-fifth for at least three years. It does not follow, of course, that those who have spent months or years in hospital have been continuously in need of hospital care; on the contrary, most of the long-stay patients have only recently developed the conditions necessitating their inclusion in this group. If the necessary alternative facilities had been available, they need only recently have been transferred to an acute hospital, thus reducing the mean duration of stay.

Table IX (p. 118; see also Fig. 5A) gives details of mobility and continence; about a quarter are incontinent, and two-thirds are confined to bed. Objections may be raised to the admission of incontinent patients to acute hospitals, but in many of these cases the incontinence is a temporary phenomenon associated with the acute illness and responsive to adequate treatment. Under present conditions in hospitals for the chronic sick, this transient incontinence frequently remains as a permanent disability when the acute illness has subsided.

With these data before us, we may examine more realistically than has hitherto been possible the

TABLE V

DIAGNOSIS AND ATTENTION REQUIRED BY PATIENTS WITHOUT GROSS MENTAL CHANGE CONSIDERED SUITABLE FOR HOSPITALS (106 MALES)*

Attention Required	No. of Cases	Comments
1. *Acute Illness* (41)		
Cardiac failure	18	
Recent hemiplegia	6	
Acute bronchitis	14	
Other	3	Tonsillitis; herpes zoster; conjunctivitis.
2. *Dressings* (33)		
Gangene of foot	7	
Leg sepsis and ulceration	9	Ulcer (4); sepsis (5).
Pressure sore	3	Advanced disseminated sclerosis; paraplegia (2).
Carbuncle	2	
Other skin conditions	2	Exfoliative dermatitis; severe eczema.
Suprapubic cystotomy	6	With cystitis and requiring irrigation.
Recent fracture	4	Femur (2); tibia and fibula; clavicle.
3. *Injections* (14)		
Advanced carcinoma	12	
Other	2	Pernicious anaemia; syphilis.
4. *Investigation* (18)	18	Includes: unexplained jaundice; diarrhoea; vomiting; anaemia; vertigo; oedema of legs; haematuria; etc.

* Includes patients requiring skilled nursing, and/or medical attention, once a week or more frequently.

TABLE VI

DIAGNOSIS AND ATTENTION REQUIRED BY PATIENTS WITHOUT GROSS MENTAL CHANGE CONSIDERED SUITABLE FOR HOSPITALS (83 FEMALES)*

Attention Required	No. of Cases	Comments
1. *Acute Illness* (31)		
Cardiac failure	12	
Recent hemiplegia	3	
Acute bronchitis	8	
Acute eye conditions	4	Conjunctivitis (3); glaucoma.
Other	4	Otitis media (2); subphrenic abscess; thyrotoxicosis.
2. *Dressings* (18)		
Gangrene of foot	2	
Leg sepsis and ulceration	9	Ulcer (6); sepsis (3).
Pressure sore	1	Advanced paralysis agitans (bedfast 4 years before admission).
Carbuncle	1	Diabetes.
Other skin conditions	5	Psoriasis (2); exfoliative dermatitis; eczema; pemphigus.
3. *Injections* (22)		
Advanced carcinoma	13	
Syphilis	3	All cases of long standing.
Pernicious anaemia	3	
Diabetes	3	
4. *Investigation* (12)	12	Includes: haematemesis; jaundice; urinary infection; haemoptysis; melena; epileptiform convulsions; ? hyperthyroidism; etc.

* Includes patients requiring skilled nursing, and/or medical attention once a week or more frequently.

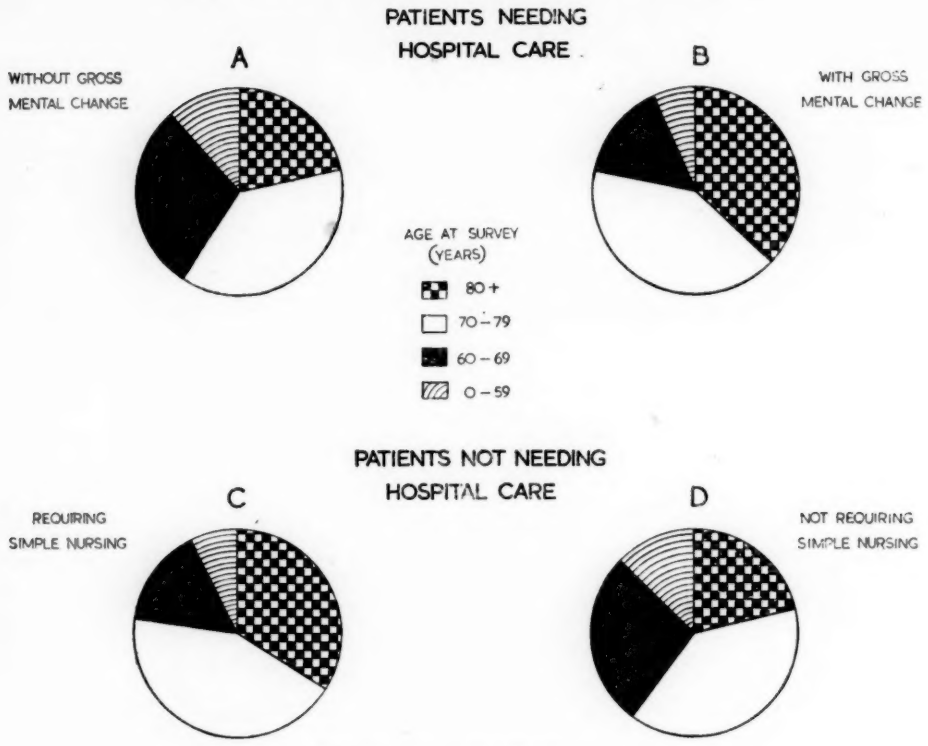

FIG. 3.—Age distribution
(see Tables VII, X, XVII, XXI).

suggestion that the chronic sick should in future be cared for in the wards of general hospitals. This view has been supported by the following considerations:

1. It is very difficult to attract nursing and medical staff to hospitals which cater exclusively for this class of patient.
2. All nurses and doctors should have some experience of the care of the elderly chronic sick.
3. Many patients require the type of investigation and treatment which can only be provided with certainty in a general hospital.

One further consideration may be added. Unless we accept as inevitable the state of apathy and resignation which has characterized these institutions in the past, and which has more in common with the nineteenth century workhouse than with the twentieth century hospital, it is important that the chronic sick should no longer be isolated from the acute sick. Many of them are in fact acutely ill, and merit the attention of the general hospital.

To this proposal there has appeared to be only

TABLE VII

AGE OF PATIENTS WITHOUT GROSS MENTAL CHANGE CONSIDERED SUITABLE FOR HOSPITALS (see Fig. 3A)

Sex	Age at Survey (Years)				Totals
	0-59	60-69	70-79	80 and over	
Males ..	15 (14·2)	28 (26·4)	40 (37·7)	23 (21·7)	106 (100)
Females ..	7 (8·4)	27 (32·5)	31 (37·4)	18 (21·7)	83 (100)
All patients	22 (11·6)	55 (29·1)	71 (37·6)	41 (21·7)	189 (100)

TABLE VIII

DURATION OF STAY OF PATIENTS WITHOUT GROSS MENTAL CHANGE CONSIDERED SUITABLE FOR HOSPITALS (see Fig. 4A)

Sex	Duration of Stay (Months)				Totals
	0-2	3-11	12-35	36 and over	
Males ..	64 (60·4)	17 (16·0)	10 (9·4)	15 (14·2)	106 (100)
Females ..	32 (38·5)	15 (18·1)	17 (20·5)	19 (22·9)	83 (100)
All patients	96 (50·8)	32 (16·9)	27 (14·3)	34 (18·0)	189 (100)

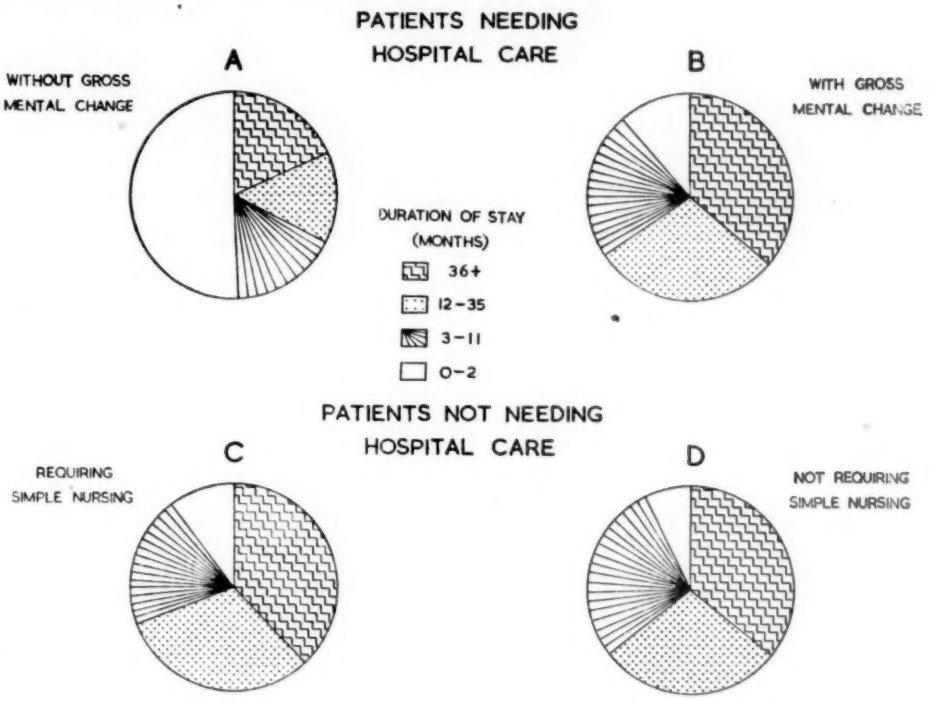

FIG. 4.—Duration of stay in hospital (see Tables VIII, XI, XVIII, XXII).

one objection, but it is a serious one. If hospital beds needed for the chronic sick are 2·0 to 2·5 per 1,000 of the population, as suggested by national figures available from the hospital surveys conducted by the Ministry of Health,* roughly one-third of the accommodation of general hospitals† would be needed to provide them. But if, as our data suggest, only about one-fifth of the patients are suitable for this type of hospital, the necessary proportion of beds is about one-tenth‡; and what has previously been an attractive also becomes a practical possibility.

Without more knowledge of the situation in other parts of the country, as well as of the extent to which this commitment can be further reduced by adequate medical and social services, the figure given cannot have the authority of a final estimate. It is likely to be very much nearer to it than any so far available, and gives good reason for believing that it should eventually be possible for general hospitals to accept this additional responsibility without serious embarrassment to their traditional work.

(*b*) *Patients without Gross Mental Change, requiring only Simple Nursing and Infrequent Medical Attention.*—As has been stated, slightly over half the patients are of this type, and in Table IV (and Fig. 2) they are classified as suitable for their own homes or for institutions other than hospitals. Whether this classification is reasonable cannot be decided without reference to the information about diagnosis given in Tables XIII and XIV for males and females respectively. The tables include one indefinite entity (senility), but indicate that most patients are suffering from well-recognized diseases, quite properly referred to as chronic diseases, some of which are characterized by long periods in which neither skilled nursing nor frequent medical attention is necessary. Three of the largest groups (chronic bronchitis, hemiplegia-recovered, arthritis) are conspicuous examples. Most of the patients are old (93 per cent. over 60; cf. Table X and Fig. 3C) and have been in hospital for a considerable period (90 per cent. for at least three months, 70 per cent. for at least a year; cf. Table XI and Fig. 4C).

* Ministry of Health Hospital Surveys (H.M.S.O., 1945; 1946).

† 2·5 beds for the chronic sick in relation to 5·0 beds per 1,000 of population for the acute sick.

‡ 0·5 beds for the chronic sick in relation to 5·0 beds per 1,000 of population for the acute sick.

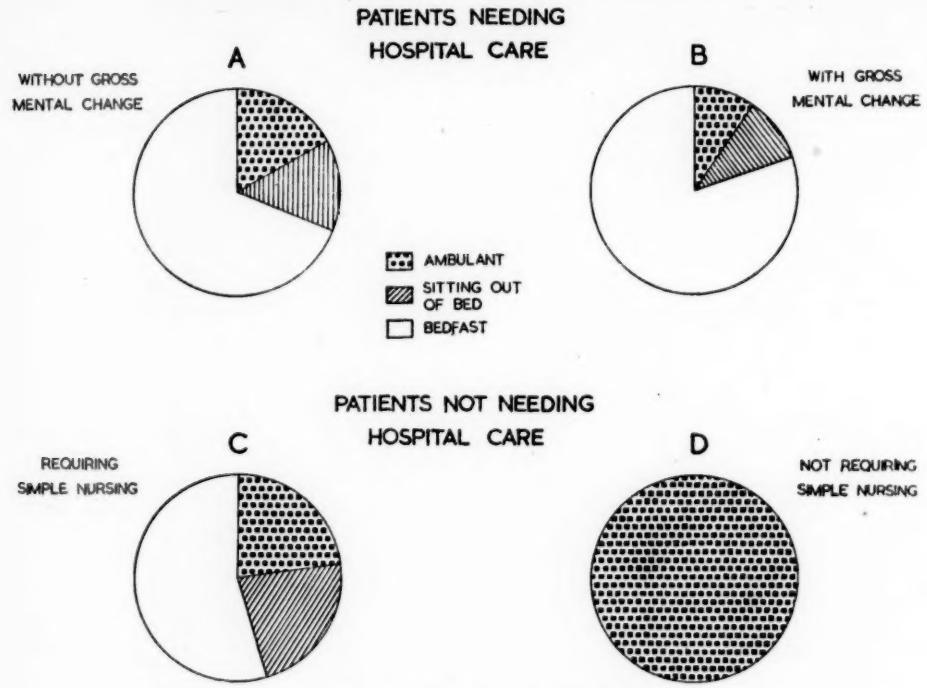

FIG. 5.—Degree of mobility
(see Tables IX, XII, XIX, XXV).

Tables XIII and XIV also show that about one-fifth of the men and one-quarter of the women have some kind of mental abnormality, of a degree which would not necessitate reconsideration of disposal (patients requiring supervision because of their mental state are excluded and discussed below under a separate heading). About one-third of the men, and less than one-fifth of the women are ambulant, and about one-third of the women and less than one-fifth of the men are incontinent (Table XII and Fig. 5C). It may be felt that patients who are incontinent require skilled nursing, but where there is no other reason we have considered this insufficient grounds for admitting them to hospital.

It is evident that nearly all these patients may at

TABLE IX

MOBILITY AND CONTINENCE OF PATIENTS WITHOUT GROSS MENTAL CHANGE CONSIDERED SUITABLE FOR HOSPITALS
(see Fig. 5A)

Sex	Males				Females			
Mobility	Bed-fast	Sitting out of bed	Ambulant	Totals	Bed-fast	Sitting out of bed	Ambulant	Totals
No. Continent ..	54	10	12	76 (71·7)	36	11	14	61 (73·5)
No. Incontinent (urine and/or faeces) ..	23	3	4	30 (28·3)	17	3	2	22 (26·5)
Totals	77 (72·6)	13 (12·3)	16 (15·1)	106 (100)	53 (63·8)	14 (16·9)	16 (19·3)	83 (100)

TABLE X

AGE OF PATIENTS NEEDING SIMPLE NURSING AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR FOR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 3C)

Sex	Age at Survey (Years)				Totals
	0-59	60-69	70-79	80 and over	
Males ..	21 (9·6)	43 (19·5)	102 (46·4)	54 (24·5)	220 (100)
Females ..	19 (5·8)	42 (12·8)	136 (41·3)	132 (40·1)	329 (100)
All patients	40 (7·3)	85 (15·5)	238 (43·3)	186 (33·9)	549 (100)

TABLE XI

DURATION OF STAY OF PATIENTS NEEDING SIMPLE NURSING AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR FOR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 4C)

Sex	Duration of Stay (Months)				Totals
	0-2	3-11	12-35	36 and over	
Males ..	32 (14·6)	54 (24·5)	54 (24·5)	80 (36·4)	220 (100)
Females ..	25 (7·6)	58 (17·6)	118 (35·9)	128 (38·9)	329 (100)
All patients	57 (10·4)	112 (20·4)	172 (31·3)	208 (37·9)	549 (100)

any time require the service of a nurse or doctor. But if this possibility is considered a sufficient reason for their retention in hospital during periods of remission, there is little prospect of relieving the pressure on hospital beds. It should not be beyond the bounds of administrative possibilities to admit these patients to hospital during the acute or terminal phase of illness, and to arrange alternative accommodation at other times.

(*c*) *Patients without Gross Mental Change Requiring only Domestic Services and Infrequent Medical Attention.*—In respect of diagnosis (Tables XV and XVI), age (Table XVII and Fig. 3D), and duration of stay (Table XVIII and Fig. 4D), these patients are very much like those in the previous group; they differ mainly in that all are ambulant and all but one are continent (Table XIX and Fig. 5D), and in consequence they do not need the sort of personal attention described as simple nursing. Indeed comparisons of the diagnoses in Tables XV and XVI with those in Tables XIII and XIV indicate that the division here made with an eye to the administrative problem mainly separates different stages in the course of the same illnesses.

The administrative significance of the distinction between groups (*b*) and (*c*) rests on the assumption that patients who do not need simple nursing require only domestic services and can dispense with any kind of personal supervision. Closer examination of Tables XV and XVI indicates that this is not the case. Though all are ambulant, the majority of these patients are not able to go out of doors, and many cannot climb stairs. Indeed, after careful consideration only a few of them were judged suitable for discharge to the ordinary type of municipal home, and some had recently been admitted from such homes because facilities were inadequate for their care. The same considerations inevitably determine in many cases whether patients can be accepted in their own homes.

Together groups (*b*) and (*c*) make up three-fifths of the present hospital population. Whether in future most of them can be cared for in their own homes or in institutions cannot be decided on the

TABLE XII

MOBILITY AND CONTINENCE OF PATIENTS NEEDING SIMPLE NURSING AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR FOR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 5C)

Sex	Males				Females			
Mobility	Bed-fast	Sitting out of Bed	Ambulant	Totals	Bed-fast	Sitting out of Bed	Ambulant	Totals
No. Continent ..	64	49	69	182 (82·7)	114	46	48	208 (63·2)
No. Incontinent (urine and/or faeces) ..	29	7	2	38 (17·3)	93	22	6	121 (36·8)
Totals	93 (42·3)	56 (25·4)	71 (32·3)	220 (100)	207 (62·9)	68 (20·7)	54 (16·4)	329 (100)

TABLE XIII

DIAGNOSIS OF PATIENTS NEEDING SIMPLE NURSING ONLY, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (220 MALES)

Diagnosis	Continent			Incontinent		
	No. of Cases	Mental State		No. of Cases	Mental State	
		Normal	Abnormal§		Normal	Abnormal§
1. *Hemiplegia*	31	28	3	14	7	7
2. "*Senility*"*	37	33	4	8	5	3
3. *Arthritis*	16	14	2	4	3	1
4. *Chronic Bronchitis*	27	22	5	4	2	2
5. *Cardiac Failure*	16	14	2	—	—	—
6. *Old Fractures of Leg*†	16	12	4	—	—	—
7. *Neurological Disease*						
Paralysis agitans	5			—		
Post encephalitis	1			—		
Disseminated sclerosis	3			—		
Lateral sclerosis	2			1		
Tabes	3			2		
Paraplegia	4			1		
Other known diagnoses	3			—		
Other unknown diagnoses	4			—		
	25	22	3	4	2	2
8. *Miscellaneous*						
Prostatic disease‡	3			4		
Chronic nephritis	1			—		
Diabetes (treated by diet only)	3			—		
Carcinoma of lung	1			—		
Recovered from leg sepsis	4			—		
Paget's disease	1			—		
Popliteal aneurysm	1			—		
	14	12	2	4	3	1
	182	157	25	38	22	16

* Of 37 continent patients: 8 are blind; 4 have only one leg; and 10 have vertigo. Of 8 incontinent patients: 3 have vertigo; 2 were admitted from municipal homes; 3 were neglected or destitute on admission.

† Femur (12); tibia and fibula (4).

‡ All with symptoms: frequency; haematuria; or cystitis.

§ Mental abnormality here refers to mental changes which do not necessitate constant supervision, e.g. dullness, apathy, speech difficulty, aphasia, loss of memory, some degree of confusion, "wandering".

evidence. Table XX and Fig. 6 give the home facilities now available for each of the four main classes of patient and show that over half have no home. The main interest of the table is in the two classes ((*b*) and (*c*)) not considered to require hospital care, of which 39 per cent. and 27 per cent. respectively have homes to which they could be discharged if the appropriate services were made available. This implies that about one-fifth of the present hospital population could be discharged in this way, though in practice some of the patients may not wish to return home even if provided with the necessary facilities for their care.

(*d*) *Patients with Gross Mental Change.*—About one-fifth of the patients have in common their need for supervision because of gross mental change, and Tables XXIII and XXIV give details of diagnosis for males and females respectively. All or nearly all these patients could be certified, but in many cases certification and admission to mental hospitals would be most undesirable.

In Tables XXIII and XXIV, classes 2 (mental defect), 3 (psychosis), and 4 (neurological disease) could be regarded as suitable for mental hospitals, and no doubt examples of the other conditions specified could also be found in them. Mental hospitals are not, however, equally happy about the acceptance of all these groups; for example, most hospitals prefer not to take the elderly senile patient. Moreover the certification of patients who become abnormal when they are very old, or who suffer from other acute or chronic illness not directly associated with their mental state, is often unacceptable to relatives. If institutions for the chronic sick do not survive in their present form, it may therefore be desirable to create separate facilities apart from the mental hospitals for some of the patients in this group.

TABLE XIV

DIAGNOSIS OF PATIENTS NEEDING SIMPLE NURSING ONLY, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (329 FEMALES)

Diagnosis	Continent			Incontinent		
	No. of Cases	Mental State		No. of Cases	Mental State	
		Normal	Abnormal§		Normal	Abnormal§
1. *Hemiplegia*	28	25	3	35	21	14
2. "*Senility*"*	46	35	11	33	19	14
3. *Arthritis*	44	40	4	19	12	7
4. *Chronic Bronchitis*	17	13	4	11	6	5
5. *Cardiac Failure*	26	22	4	5	1	4
6. *Old Fractures of Leg*†	16	14	2	6	4	2
7. *Neurological Disease*						
Paralysis agitans	5			4		
Post encephalitis	3			—		
Disseminated sclerosis	2			1		
Cerebral syphilis	2			—		
Huntingdon's chorea	2			—		
Cerebellar ataxy	1			1		
Epilepsy	1			—		
Paraplegia (Paget's)	—			1		
	16	14	2	7	5	2
8. *Leg Sepsis and Ulceration*‡	7	7	—	—	—	—
9. *Miscellaneous*						
Diabetes	2			1		
Myxoedema	1			—		
Pernicious anaemia (not having liver)	1			—		
Urinary infection (now recovered)	1			—		
Chronic nephritis	1			—		
Labyrinthine vertigo	1			—		
Vertigo following mastoidectomy	—			1		
Paget's disease	—			1		
Prolapsed rectum	—			1		
Femoral thrombosis (recovered)	—			1		
Diagnosis uncertain	1			—		
	8	6	2	5	2	3
	208	176	32	121	70	51

* Of 46 continent patients: 9 are blind; 11 were admitted because of vertigo; 10 were neglected or destitute; 3 were considered too feeble in a municipal home; others had temporary acute illnesses (enteritis, urinary infection, lumbago, etc.). Of 33 incontinent patients: 4 are blind; 7 were admitted because of vertigo; 5 were neglected or destitute; 2 were admitted from a municipal home because of incontinence; 4 because of leg sepsis or ulceration; 1 patient was admitted because of constipation (and has been incontinent of faeces ever since).

† Of 16 continent patients, fractures are as follows: femur (12); tibia and fibula (2); pelvis (1); patella (1). Of 6 incontinent patients, fractures are as follows: femur (5); tibia and fibula (1).

‡ Healed gangrene, varicose ulcers, etc.

§ Mental abnormality here refers to mental changes which do not necessitate constant supervision, e.g. dullness, apathy, speech difficulty aphasia, loss of memory, some degree of confusion, "wandering".

As one might expect, the mean age is high (Table XXI and Fig. 3B) and most patients have been in hospital for a considerable period (36 per cent. over three years; Table XXII and Fig. 4B). The problems of nursing care are formidable, since only about 10 per cent. are ambulant and the great majority are incontinent (Table XXV and Fig. 5B).

DISCUSSION

It seems advisable to consider first the limitations of an enquiry restricted to the patients in a hospital for the chronic sick. Even if we assume that Western Road Infirmary is typical of other institutions of the same type (and we shall later have data from the Stoke area for comparison), we are unable to offer reliable estimates of the proportion of chronic sick in different age groups in the population as a whole, much less to assess accurately their medical and social needs. We are handicapped by the lack of information about the present age distribution of the general population, as well as by the fact that some patients of the same type are cared for in general or mental hospitals or in their own homes.

We should recognize a further reason for caution before accepting results based on a cross section of

TABLE XV

DIAGNOSIS OF PATIENTS REQUIRING NO NURSING OR FREQUENT MEDICAL ATTENTION, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (41 MALES)*

Diagnosis	Ambulant	
	Indoors Only	Out of Doors
Cardiac Failure (recovered)	2	4
Hemiplegia (recovered) ..	3	4
Chronic Bronchitis ..	10	3
Peptic Ulcer (on diet) ..	1	1
Prostatic Enlargement (admitted with retention) ..	1	1
Paralysis agitans	2	—
Arthritis	2	—
Old Fracture of Femur (with walking disability)	2	—
Healed Varicose Ulcer (with frequent relapses) ..	1	—
Post-encephalitis ..	—	1
Haematuria (cause unknown)	—	1
None†	—	2
Totals	24	17

* Only 3 patients in this group have homes with some facilities for their care; they are unwilling to go home, because they believe they would be a nuisance in households with children.

† Two patients, aged 72 and 82, admitted with no illness, but in a neglected state. These are the only patients in this group considered suitable for discharge to the ordinary type of municipal home.

TABLE XVI

DIAGNOSIS OF PATIENTS REQUIRING NO NURSING OR FREQUENT MEDICAL ATTENTION, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (29 FEMALES)*

Diagnosis	Ambulant	
	Indoors Only	Out of Doors
Cardiac Failure (recovered)	7	3
Hemiplegia (recovered) ..	3	—
Chronic Bronchitis ..	3	—
Paralysis agitans	2	—
Old Fracture (with walking disability)	2	—
Carcinoma of breast (no evidence of secondaries)	1	—
Mental Defect (high grade)	—	1
Huntingdon's Chorea ..	—	1
None	3†	3‡
Totals	21	8

* Only 2 patients in this group have homes with some facilities for their care; they are unwilling to return home, because they believe they would be a nuisance in households with children.

† Three patients, considered senile, who are old and very feeble.

‡ Only two patients, aged 65 and 70, could be discharged to the ordinary type of municipal home. The third, aged 81, was recently admitted from a municipal home because of " senility ".

TABLE XVII

AGE OF PATIENTS REQUIRING NO NURSING OR FREQUENT MEDICAL ATTENTION, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 3D)

Sex	Age at Survey (Years)				Totals
	0-59	60-69	70-79	80 and over	
Males ..	5 (12·2)	12 (29·2)	17 (41·5)	7 (17·1)	41 (100)
Females ..	4 (13·8)	7 (24·1)	10 (34·5)	8 (27·6)	29 (100)
All patients	9 (12·8)	19 (27·1)	27 (38·7)	15 (21·4)	70 (100)

TABLE XVIII

DURATION OF STAY OF PATIENTS REQUIRING NO NURSING OR FREQUENT MEDICAL ATTENTION, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 4D)

Sex	Duration of Stay (Months)				Totals
	0-2	3-11	12-35	36 and over	
Males ..	4 (9·8)	7 (17·1)	16 (39·0)	14 (34·1)	41 (100)
Females ..	1 (3·5)	13 (44·8)	4 (13·8)	11 (37·9)	29 (100)
All patients	5 (7·1)	20 (28·6)	20 (28·6)	25 (35·7)	70 (100)

TABLE XIX

MOBILITY AND CONTINENCE OF PATIENTS REQUIRING NO NURSING OR FREQUENT MEDICAL ATTENTION, AND CONSIDERED SUITABLE FOR THEIR OWN HOMES OR INSTITUTIONS OTHER THAN HOSPITALS (see Fig. 5D)

Sex	Males			Females		
Mobility	Indoors Only	Fully Ambulant	Totals	Indoors Only	Fully Ambulant	Totals
No. Continent	24	17	41 (100)	20	8	28 (96·6)
No. Incontinent (urine and/or faeces)	—	—	—	1*	—	1 (3·4)
Totals ..	24 (58·5)	17 (41·5)	41 (100)	21 (72·4)	8 (27·6)	29 (100)

* A woman of 76 years with partial incontinence of urine due to procidentia incompletely controlled by a ring pessary.

the present hospital population as an accurate guide to future policy. The adequacy of the medical services provided determines to some extent the dimensions of the subsequent administrative problem; for example, the proportion of patients confined to bed or incontinent undoubtedly can be

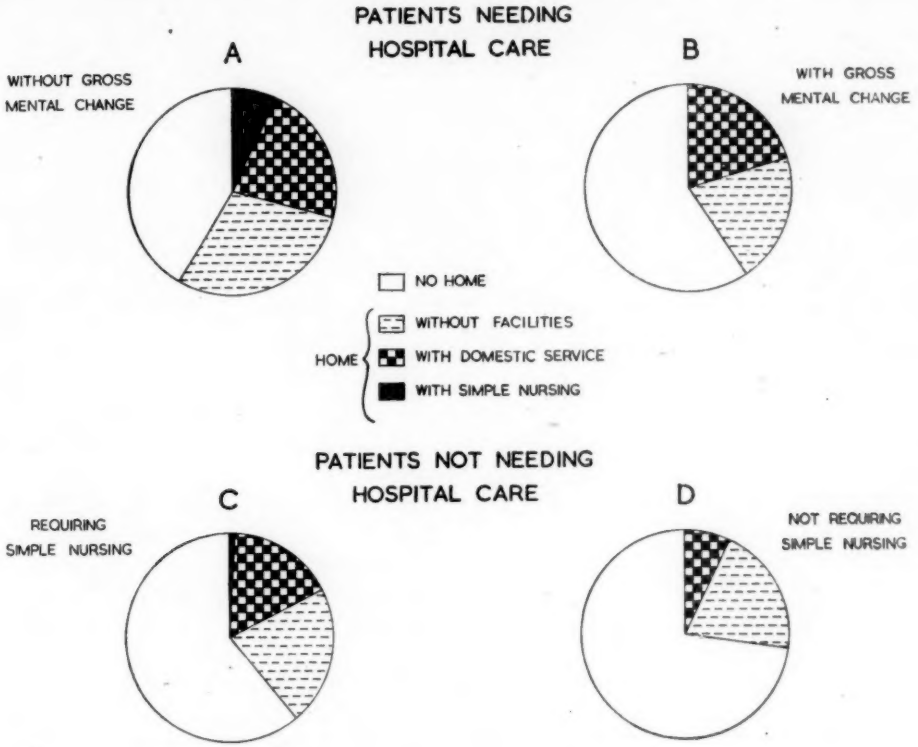

FIG 6.—Facilities available at home (see Table XX).

TABLE XX

FACILITIES AVAILABLE AT HOME (ALL PATIENTS) (see Fig. 6)

Home Available	Patients without Gross Mental Change			Patients with Gross Mental Change	Totals
		Institution or Own Home			
	Hospital (*a*)	With Simple Nursing (*b*)	Without Simple Nursing (*c*)	Hospital (*d*)	
None	78 (41·3)	334 (60·8)	51 (72·9)	117 (59·4)	580 (57·7)
Without Simple Nursing or Domestic Service	56 (29·6)	119 (21·7)	14 (20·0)	40 (20·3)	229 (22·8)
With Domestic Service but without Simple Nursing ..	42 (22·2)	91 (16·6)	5 (7·1)	40 (20·3)	178 (17·7)
With Simple Nursing	13 (6·9)	5 (0·9)	—	—	18 (1·8)
Totals	189 (100)	549 (100)	70 (100)	197 (100)	1,005 (100)

TABLE XXI

AGE OF PATIENTS WITH GROSS MENTAL CHANGE (see Fig. 3B)

	Age at Survey (Years)				Totals
	0-59	60-69	70-79	80 and over	
Males ..	6 (6·8)	14 (15·9)	39 (44·3)	29 (33·0)	88 (100)
Females ..	7 (6·4)	16 (14·7)	42 (38·5)	44 (40·4)	109 (100)
All patients	13 (6·6)	30 (15·2)	81 (41·1)	73 (37·1)	197 (100)

TABLE XXII

DURATION OF STAY OF PATIENTS WITH GROSS MENTAL CHANGE (see Fig. 4B)

	Duration of Stay (Months)				Totals
	0-2	3-11	12-35	36 and over	
Males ..	14 (15·9)	24 (27·3)	21 (23·9)	29 (32·9)	88 (100)
Females ..	9 (8·3)	21 (19·3)	37 (33·9)	42 (38·5)	109 (100)
All patients	23 (11·7)	45 (22·8)	58 (29·4)	71 (36·1)	197 (100)

TABLE XXIII

DIAGNOSIS OF PATIENTS WITH GROSS MENTAL CHANGE (88 MALES)

Diagnosis	No. of Cases	Age		Continence	
		Mean	Range	Continent	Incontinent
1. *Senile Dementia only*	26	77·5	65-90	10	16
2. *Mental Defect*	—	—	—	—	—
3. *Psychosis*	3	68	54-72	3	—
4. *Neurological Disease*					
Post-encephalitis	2	42			
Paralysis agitans	2	67			
Cerebral syphilis	2	68			
Neurofibromatosis	1	66			
Advanced disseminated sclerosis	1	43			
	8	57	37-76	5	3
5. *Hemiplegia*	31	73	54-89	4	27
6. *Other Medical Conditions*					
Cardiac failure	7	80			
Bronchitis	3	82			
Gross arthritis	3	78			
Carcinoma	1	78			
Old fracture	2	74·5			
Leg ulcer	2	76·5			
Ischio-rectal abscess	1	77			
Haematuria	1	79			
	20	78	69-95	6	14
	88			28	60

TABLE XXIV

DIAGNOSIS OF PATIENTS WITH GROSS MENTAL CHANGE (109 FEMALES)

Diagnosis	No. of Cases	Age		Continence	
		Mean	Range	Continent	Incontinent
1. *Senile Dementia only*	39	82	74-96	5	34
2. *Mental Defect*	3	60	50-67	2	1
3. *Psychosis*	1	69	69	1	—
4. *Neurological Disease*					
Post-encephalitis	3	44	42-48		
Paralysis agitans	1	73	73		
Cerebral syphilis	3	64	59-67		
Huntingdon's chorea	2	61·5	61-62		
Epilepsy	1	73	73		
	10	59	42-73	5	5
5. *Hemiplegia*	22	72	53-88	2	20
6. *Other Medical Conditions*					
Cardiac failure	6	76	62-84		
Bronchitis	8	81	74-88		
Gross arthritis	9	80	73-87		
Carcinoma	3	77	74-80		
Old fracture	5	82	78-88		
Gangrene of foot	1	66	66		
Leg ulcer	1	85	85		
Paget's disease	1	62	62		
	34	79	62-88	9	25
	109			24	85

TABLE XXV

MOBILITY AND CONTINENCE OF PATIENTS WITH GROSS MENTAL CHANGE (see Fig. 5B)

Sex	Males				Females			
Mobility	Bed-fast	Sitting out of Bed	Ambulant	Totals	Bed-fast	Sitting out of Bed	Ambulant	Totals
No. Continent ..	13	5	10	28 (31·8)	10	5	9	24 (22·0)
No. Incontinent (urine and/or faeces) ..	58	2	—	60 (68·2)	77	8	—	85 (78·0)
Totals	71 (80·7)	7 (7·9)	10 (11·4)	88 (100)	87 (79·8)	13 (11·9)	9 (8·3)	109 (100)

reduced by better services. But although improved services may diminish the proportion of individuals in each age group requiring attention, the proportion of individuals in the general population requiring attention will increase as more people survive to older ages.

With these difficulties in mind, we may indicate the conclusions which can legitimately be drawn from this survey. We are here concerned mainly with disposal and our suggestions are based on a detailed examination of the medical and social needs of each patient; they make it clear that patients now listed as chronic sick do not form a homogeneous group with consistent medical and social needs. As we shall discuss more fully in a later paper, the present hospital population is highly selected in respect of age, marital status, and social circumstances, and it is these features as much as the special nature of their medical problems which in the past have determined their segregation from the acute sick. Estimates of hospital bed requirements which have been based on national returns are for this reason misleading, since they ignore the administrative significance of the distinction between two classes of patient commonly described as chronic sick, namely, (1) patients whose illnesses require continuous skilled nursing or medical attention; and (2) patients whose illnesses, though chronic, are characterized by periods of remission in which neither medical nor nursing attention is needed.

It is possible to speak with most confidence about the disposal of that section of the hospital population which requires the kind of medical and nursing service provided in a general hospital. In our survey, about a fifth of the patients are of this type and they differ chiefly in age from those ordinarily admitted. Good reasons have been suggested for caring for the chronic sick in the general hospitals, the most impressive of them being the difficulty of staffing isolated institutions. If the proportion of chronic sick whose needs can best be satisfied in general hospitals is not greatly in excess of our experience, this suggestion becomes a practical administrative possibility.

It is also evident that patients who require supervision because of their mental state (also about one-fifth in our survey) must be cared for in hospital; the type of hospital is less certain. Few general hospitals are equipped for the supervision of this class of patient, and most mental hospitals are reluctant to take them. Detailed consideration of the diagnoses indicates that this also is not a homogeneous group, and includes many patients indistinguishable from others already in mental hospitals. A decision about disposal could be made more intelligently if similar data were available from mental hospitals. For the present, it may be stated that some of these patients could quite properly be admitted to a mental hospital; for others (for example the senile dementias), it may be desirable to create separate institutions. We think particularly of elderly senile patients, some of whom require medical attention for illness not directly associated with their abnormal mental state, and whose certification would in many cases distress the relatives.

There remain for consideration three-fifths of the patients of the survey who required no medical or nursing attention of a kind or frequency necessitating admission to hospital, and it is by the disposal of this group that most relief can be given to hospitals. Clearly from the point of view of the administration, and one hopes of the patients also, no alternative can be as satisfactory as their own homes, where the necessary facilities and assistance are available. It is equally clear that in very many

cases these are totally inadequate, and in future local authorities will no doubt insure that no patient leaves his home, or fails to return to it after hospital treatment, for lack of any service which the community can reasonably be expected to provide.

Until fuller information is available about the patients on hospital waiting lists, whose personal circumstances are more representative of present conditions, it is unprofitable to speculate on the extent to which the needs of this large class of patients can be met at home. It is quite certain that few of those now in hospital can be sent home, since few of them have homes to which they could or would wish to return. Moreover, the proportion of unmarried or widowed persons without a home of their own at the time of admission to hospital is high, and indicates that alternative accommodation must be found if such patients are not to continue to fill large numbers of hospital beds. If hospitals are to be relieved of that part of the problem which is not essentially their responsibility, it will be necessary to supplement the home services referred to above with institutions which can offer simple nursing or some personal supervision as well as domestic service.

Is this the responsibility of regional hospital boards or of local health authorities? It must be remembered that with few exceptions we are discussing the care, not of two separate classes of patient but of the same patients at different stages of illness; their medical and social needs may not always be readily squared with a division of responsibility between several authorities. None the less, if we continue to view this as solely a hospital matter, the difficulties will remain as formidable as ever, and will only be relieved by a considerable proliferation of hospital facilities.

Because the present position has been greatly influenced by earlier deficiencies in medical and social services, it would be wise to attach significance to the nature of the facilities which this survey suggests, and to let future experience indicate the relative proportions of different types required. Although, for the reasons discussed, it is not possible immediately to provide alternative arrangements for many of the chronic sick now in hospital, the evidence suggests that the existing institutions, with their attendant difficulties in staffing and equipment, should not survive in their present form. That part of their work which is truly a hospital responsibility can be taken over by the general and mental hospitals, and the remainder by the local health authorities in co-operation with general practitioners and voluntary agencies.

Summary

An examination has been made of the medical, nursing, and social needs of the 1,005 patients in an institution for the chronic sick transferred to the Birmingham Regional Hospital Board in July, 1948.

On the basis of their present requirements, it is suggested that if the necessary facilities were available these patients might be cared for as follows:

1. One-fifth in general hospitals (patients requiring frequent medical attention, or skilled nursing).
2. One-fifth divided between: (*a*) mental hospitals; and (*b*) other institutions which can supervise patients with abnormal mental states, whom for administrative or personal reasons it may be undesirable to certify.
3. Three-fifths divided between: (*a*) their own homes, supported by the services of local health authorities, general practitioners and voluntary agencies; and (*b*) institutions, other than hospitals, providing domestic services and simple nursing (washing, feeding, dressing).

Published estimates, based on national returns from hospitals, have put the beds required for the chronic sick at 2·0 to 2·5 per 1,000 of the population. If the data given above are typical of other parts of the country, this figure may be sub-divided as follows:

1. *Under Hospital Authorities.*—0·5 beds per 1,000 of population in general hospitals (about one-tenth of their proposed capacity of 5·0 beds per 1,000 of the population. 0·5 beds per 1,000 of population in some type of mental hospital.
2. *Under Local Authorities.*—The equivalent of 1·5 beds per 1,000 of population in institutions other than hospitals, and in patients' homes.

The limitations of data based on the present population in hospitals for the chronic sick are referred to.

We have pleasure in acknowledging an indebtedness to Professor A. P. Thomson, who has contributed to this survey in many ways. The medical records were completed by Dr. Charmian Elkes, Dr. S. E. Hallissy, and Dr. P. M. Meynell, and the social records by Mrs. L. Leaver and Mrs. H. Pringle; the enquiry owes much to their work, and to the generous co-operation of Dr. Nagley and his staff at Western Road Infirmary. We are also indebted to Miss Frew, and to those other members of the Almoner's department of the Birmingham United Hospitals, who assisted in a preliminary pilot survey. The diagrams used in this paper were prepared by Miss C. Wall.

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A STUDY OF THE EFFICIENCY OF GROUPS OF EX-MINERS DISABLED BY PNEUMOCONIOSIS EMPLOYED IN LIGHT INDUSTRIES IN SOUTH WALES

BY

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In order to compare the efficiency of disabled men suffering from coal miners' pneumoconiosis with corresponding groups of other workers, two methods of approach were used: an objective approach, comparing the efficiency of a disabled group directly with a corresponding group of fit workers; and a subjective approach, obtaining the opinions of employers about the performance of the disabled men.*

The objective method immediately revealed two problems. First, what index could be used to measure "efficiency"; and, secondly, how could "ex-miners disabled by pneumoconiosis" be defined? The efficiency of a certain type of labour can be measured most directly by output. Unfortunately, in this case it was not possible to use output as a measure of the efficiency of the disabled men, because of the lack, at the time of the enquiry, of firms in South Wales employing a considerable number of such men on individual piece-rates. Where piece-rates were paid, they were group piece-rates, and although some disabled men may have been included in the group, output could not be attributed to individuals. Most of the disabled men in South Wales were employed on jobs, such as store-keeping and labouring, where they were only indirectly productive. Consequently, other less direct measures had to be used. Absence from work, labour turnover, and accident rates can all be used as less direct quantitative measures of "efficiency". In the objective part of this investigation absence from work has been used as the measure of efficiency. There is, of course, no necessary connexion between absence and efficiency on the job, but the two are probably inversely related. The nature of the data available prevented the use of labour turnover or industrial accidents as other measures of efficiency.

For the purpose of this study some clear-cut distinction had to be drawn between men disabled by pneumoconiosis and all other men. The former were defined as those men who had been certified by the Silicosis Medical Board. All other men were regarded as being "fit". In view of the fact that in the early stages of pneumoconiosis there may be some uncertainty in diagnosis it is possible that in some cases this definition may have been somewhat arbitrary. Nevertheless a line had to be drawn somewhere, and certification had the merit of being precise from the social, if not from the medical, point of view.

There is one important corollary to this definition of disabled men. Pneumoconiosis cases constitute such a heterogeneous group as far as age and physical disability are concerned, that one might expect the efficiency and absenteeism of such men to vary considerably. However, since we are only concerned here with men employed in light industry, we are dealing with a more homogeneous group than the general population of disabled men, since it is probable that the employers would only take on the fitter men.

Collection of Data

Absence Records.—Despite the fact that there are a large number of certified disabled men employed in industry in South Wales, their industrial distribution is so widespread that the men selected for this investigation were all factory workers employed in light industry, for it proved impossible to find groups of sufficient size in other types of employment.

The most obvious method of finding these men in industry was to ask their employers. Unfortunately, in many cases, employers did not know which of their employees were disabled by pneumoconiosis. The men concerned were sometimes very reluctant to reveal their disability because they believed that they would be dismissed if identified as cases of pneumoconiosis. In a factory in

* The term "disabled men" in this study will henceforth be used as a brief description of ex-miners certified as disabled by pneumoconiosis, except where otherwise stated.

Monmouthshire, for example, the labour manager said that as far as he knew there were no disabled men employed in the factory, yet the factory policeman, in conversation, said that there were several such cases actually in employment there. The fact that many of these men remained unremarked was an indirect testimonial to their working capacity but it made their identification a difficult, and sometimes highly delicate, task.

A second method of finding these men was provided by the sample inquiries carried out in 1946 by the Social Survey (1946) and Medical Research Council (Stewart, 1948). These samples supplied the names both of the men and of their current employers. Lists of names were extracted from these samples and the corresponding employers visited.

A third method was used in one factory where the entire labour force was interviewed on the job. The information obtained in this way was reliable, but for obvious reasons this direct method could be used only in special circumstances.

Only in three factories were enough disabled men found in employment to warrant study. In two of them, Factory 1 and Factory 2, the absence records of the disabled men were compared with a corresponding control group of " fit " men. In the third, Factory 3, only the absence records of the disabled men were obtained as it was not possible to select a control group there.

The precise data obtained at these factories are as follows:

In Factory 1 the time lost through absence by each of 37 disabled men employed in 1946, 60 employed in 1947, and 69 employed in 1948 was obtained and compared with the time lost by a corresponding control group of fit men* selected so as to have the same distribution within the group of age, length of employment, and working experience. Consequently, it is hoped that pneumoconiosis constitutes the only essential difference between the disabled and fit groups.

In Factory 2 the absence records in 1948 of 26 disabled men (" disabled group ") were compared with those of a corresponding group of 98 fit men (" control group ") from whom were selected, on the same basis as in the case of Factory 1, a true control group of 26 men (" selected controls "). Also, in this factory the absence records of 72 men who had disabilities other than pneumoconiosis were obtained (" disabled controls "), and from these again a true control group of 26 men (" selected disabled controls ") was selected on the same basis as before. In this way the absence records of pneumoconiosis cases were compared with those of other disabled men.

In Factory 3 only the absence records of 53 men disabled by pneumoconiosis were obtained.

To make sure that previous mining experience, apart from pneumoconiosis, was not a factor affecting absence from work, a group of ex-miners, none of whom had been certified by the Silicosis Medical Board, were also studied. At a store depot, 41 ex-miners who had not been certified as having pneumoconiosis were employed and their sickness absence in 1948 was compared with a selected control group of 41 other workers.

Employers' Opinions.—The opinions of employers concerning the efficiency of the disabled men they had employed, or were still employing, were obtained from a questionnaire sent to 150 firms in South Wales. Besides this, it was found that one firm in South Wales, which employed a number of disabled men, kept careful subjective estimates of the efficiency of all its employees. This firm kindly provided these records for some of its workers, and the opinions of the efficiency of the 24 disabled men in employment have been recorded and compared with the opinions about a corresponding control group of fit men.

Results

Absence from Work.—Before considering the periods of absence found for the different groups of men in the four places investigated, the definition of " absence " must be made clear. It was found that all the factories concerned kept their absence records under three main headings: (1) sickness absence, by which is meant absence covered by medical certificate; (2) unauthorized absence, by which is meant absence without satisfactory reason being given; and (3) authorized absence, by which is meant absence permitted by the factory for reasons other than sickness.

Authorized absence, as defined, was found to be of negligible importance so that in the tables of results only sickness absence and unauthorized absence have been recorded.

As the absence records of different groups of workers in the four places of employment are to be compared one with the other, it is important that the conditions under which the different groups of men worked were found to be very similar, both within and between each place. Likewise, the duration of employment of the men in the various groups was found not to differ greatly. In 1948 all four places of employment worked a five-day week of 44 hours and so again they were comparable. Lastly, the age distributions of the various groups

* There were more men in the control than in the disabled group in 1946 but equal numbers in 1947 and 1948. The discrepancy occurs in 1946 because, although there were originally equal numbers in the two groups, the material had to be re-analysed and completed in 1949 by which time some of the factory records were missing. The remaining groups were still well enough balanced for this not to affect comparisons between the groups.

of men were taken into account and made comparable at the time of the selection of the cases.

The absence records of the different groups of workers in the four factories will now be considered individually.

The distribution of the percentage of time at risk which was lost by the disabled and the control groups at Factory 1 is shown in Table I.

In Table I and in all subsequent tables the time at risk is the total number of shifts that occurred during the period of study, less the number lost by any form of absence other than that under consideration. For example, the time at risk when considering " unauthorized absence " in Table I is the number of shifts worked during the periods shown in each column less absence caused by authorized vacations and sickness absence.

It will be seen from Table I that the differences between the distributions of sickness absence and unauthorized absence, for both disabled and the control groups, are very small and it is probable that they would be thought of no account by an employer. The average percentage of time lost through sickness absence was smaller in the disabled group than in the controls in each year. The average percentage of time lost through unauthorized absence was, however, greater in the disabled group each year, the maximum difference being 0·61 in 1946. The statistical significance of the difference between these mean percentages may be tested, despite the forms of the distributions, by a method devised by Pitman (1937). By a suitable transformation each comparison can be made to give a value for " Student's " statistic " t," which gives, in its turn, the probability of differences as great or greater than those being found by a random

TABLE I

FREQUENCY DISTRIBUTION OF PERCENTAGE OF TIME AT RISK LOST THROUGH UNAUTHORIZED AND SICKNESS ABSENCE BY GROUPS OF DISABLED MEN AND CONTROLS IN FACTORY 1

Percentage of Time at Risk Lost	Unauthorized Absence						Sickness Absence					
	Jan. 1-Dec. 31, 1946		Jan. 1-June 30, 1947		Jan. 1-June 30, 1948		Jan. 1-Dec. 31, 1946		Jan. 1-June 30, 1947		Jan. 1-June 30, 1948	
	Disabled	Controls	Disabled	Controls	Disabled	Controls	Disabled	Controls	Disabled	Controls	Disabled	Controls
No absence	3	4	23	19	18	18	13	19	38	42	39	40
0–	12	15	32	32	34	42	15	22	38	45	39	40
1–	6	13	13	15	17	11	6	7	2	1	3	1
2–	10	7	7	4	9	5	4	—	3	3	6	3
3–	4	2	1	6	3	6	1	—	5	—	6	5
4–	1	3	2	1	1	3	4	2	6	1	—	2
5–	3	—	1	1	—	1	1	3	2	2	1	1
6–	—	—	3	—	1	—	1	1	1	—	4	3
7–	—	1	—	—	3	1	1	3	—	4	2	3
8–	—	—	—	1	1	—	2	—	1	1	—	1
9–	1	—	1	—	—	—	1	—	—	1	2	—
10–	—	—	—	—	—	—	1	1	—	1	4	1
15–	—	—	—	—	—	—	—	—	1	—	—	4
20–	—	—	—	—	—	—	—	1	1	—	—	—
25–	—	—	—	—	—	—	—	—	—	—	—	3
30–	—	—	—	—	—	—	—	1	—	—	—	—
35–	—	—	—	—	—	—	—	—	—	—	2	1
40–	—	—	—	—	—	—	—	—	—	—	—	—
45–	—	—	—	—	—	—	—	—	—	—	—	—
50–	—	—	—	—	—	—	—	—	—	1	—	—
55–	—	—	—	—	—	—	—	—	—	—	—	1
60–	—	—	—	—	—	—	—	—	—	—	—	—
Total	37	41	60	60	69	69	37	41	60	60	69	69
Mean	2·29	1·68	1·50	1·33	1·58	1·26	2·67	3·31	2·01	2·32	3·35	4·97
Upper Quartile	3·0	2·5	2·0	2·0	2·0	2·0	4·5	5·0	3·5	1·0	3·5	6·0
Percentage of the groups with absence	91·9	90·2	61·7	66·7	73·9	83·9	64·9	53·7	36·7	30·0	43·5	42·5

dichotomy of the aggregated group of disabled and controls. These probabilities are given in Table II.

The probabilities given in Table II are relatively large so that the differences found may well have occurred by chance, and the groups, therefore, may not be differentiated by their absence from work. Since, however, the disabled men have a higher unauthorized absence and a lower sickness absence than the fit men in every year (Table I), is the probability of this repeated bias likely to have arisen by chance ? The probabilities of such differences of the given sign can be combined to give a value of χ^2 which can be tested in the usual way.

For sickness absence the value of χ^2 is 8·25, which for 6 degrees of freedom, has a probability of between 0·2 and 0·3. For unauthorized absence χ^2 is 11·63, and the probability lies between 0·05 and 0·1. Thus, in neither case does the persistence of the pattern of absence over three years make the difference significant.

It may be argued that the mean percentage of absence is not the most useful measure to use, since the employer of labour will wish to know something of the range of absence he may expect. The upper quartile, to the nearest half per cent., of each distribution has, therefore, been given in addition. This is the percentage of absence which 75 per cent. of the men in each group did not exceed, and it provides, consequently, a measure of the greatest probable absence-rate shown by a majority of them. The use of the upper quartile as a measure of dispersion is arbitrary, but it was chosen as being convenient in this case. From the upper quartiles given in Table I it will be seen that in the case of unauthorized absence there was no difference between the disabled and the controlled groups, except in 1946, and in the case of sickness absence the disabled men did better than the fit men in two of the years though worse in the third. In every case the differences between the quartiles are small.

TABLE II

RESULTS OF TESTS OF SIGNIFICANCE ON THE DIFFERENCES BETWEEN THE PERCENTAGES OF TIME AT RISK LOST THROUGH ABSENCE BY VARIOUS GROUPS OF MEN IN THE DIFFERENT FACTORIES

Group	Mean	Pitman's " W "	" t "	Probability
FACTORY 1				
(*a*) *Unauthorized Absence*				
1946 Disabled	2·290	0·029	1·524	> ·13
1946 Controls	1·681			
1947 Disabled	1·500	0·0023	0·524	> ·60
1947 Controls	1·325			
1948 Disabled	1·578	0·0079	1·041	> ·30
1948 Controls	1·264			
(*b*) *Sickness Absence*				
1946 Disabled	2·674	0·004	0·540	> ·59
1946 Controls	3·310			
1947 Disabled	2·013	0·0007	0·286	> ·77
1947 Controls	2·317			
1948 Disabled	3·351	0·0085	1·081	> ·28
1948 Controls	4·972			
FACTORY 2				
Sickness Absence				
Pneumoconiosis Disabled	5·150	0·03952	1·434	Between 0·2 and 0·1
Select Controls	2·215			
Pneumoconiosis Disabled	5·15	0·02207	1·659	approx. 0·1
Controls	2·31			
All Disabled	5·05	0·032818	2·566	approx. 0·01
Controls	2·31			

Although the means and upper quartiles of the distributions of percentage absence have been found to be very similar in both the fit and disabled groups, it is possible that a similar total amount of absence could have arisen, in one group through many short absences, and in the other through few long absences. The data from Factory 1 in 1946 was analysed from this point of view, and Table III shows the duration of absence, measured by the number of consecutive shifts lost, that occurred in the two opposed groups.

TABLE III

FREQUENCY DISTRIBUTION OF NUMBER OF CONSECUTIVE WORK SHIFTS LOST BY DISABLED MEN AND CONTROLS, FACTORY 1, JAN. 1 - DEC. 31, 1946

No. of Consecutive Shifts Lost	Unauthorized Absence		Sickness Absence	
	Disabled	Controls	Disabled	Controls
½	11	12	—	—
1	198	152*	4	4
2	16	10	5	9
3	2	4	9	3
4	2	—	8	7
5	—	1	4	7
6	1	—	5	6
7	—	—	5	1
8	—	—	—	1
9	—	—	3	1
10	—	—	1	2
11	—	—	1	2
12	—	—	3	4
13	—	—	—	—
14	—	—	—	1
15–	—	—	2	1
20–	—	—	1	2
25–	—	—	—	1
30–	—	—	—	—
35–	—	—	—	—
40–	—	—	—	—
45–	—	—	—	2
50–	—	—	—	—
Mean Length of Absences	1·11	1·09	5·88	8·13
Mean No. of Absences	6·22	4·37	1·38	1·32
No. of Men	37	41	37	41

* Including one absence of 1½ shifts.

From Table III the distributions in the two groups are again seen to be very similar. The mean lengths of unauthorized absences were 1·11 shifts for disabled men and 1·09 shifts for fit men, and for sickness absence the means were 5·88 shifts and 8·13 shifts respectively, so that again, where sickness is concerned, the disabled group did slightly better than the controls. When the mean number of absences is compared, we find no difference between the groups in sickness absence, but a difference in favour of the fit men of nearly two shifts in the mean number of unauthorized absences. (This figure is, of course, related to the mean absence-rate previously obtained; an absence of one shift corresponds roughly to a rate of 0·3 per cent.)

We conclude on this limited evidence, that the slightly smaller sickness absence rate of the disabled men is the result of a total number of absences equal to those shown by the fit men but shorter in duration. The slightly higher unauthorized absence rate of the disabled is due to a larger number of absences of duration equal to those of the fit men. It will be realized that on the whole the number of absences will be of more interest to an employer than the duration of absence, since alternative arrangements must be made whether a man is absent for one shift or eight. The differences are so small, however, that no great significance can be attached to them. It was not considered worth while analysing the data for 1947 and 1948 in this way.

The employee who loses no time at all is obviously ideal as far as absence is concerned, so that the proportion of a group of workers who have periods of absence will be a measure of the deviation of this group from the ideal. From Table I once again it will be seen that the two groups of men did not differ significantly, as far as this measure was concerned, in the three years in which we have observed them.

It might well be that the absence records of certified men disabled by pneumoconiosis would be affected by the amount and kind of compensation they were receiving. Consequently, the group of disabled men in this factory was sub-divided into two groups comprising (1) those in receipt of weekly compensation, and (2) those who had settled their claim to compensation by taking a lump payment. These two groups are compared in Table IV (overleaf).

Here the numbers in the total column do not add up to the totals for disabled given in Table I. This discrepancy arises because some men settled their claim to compensation during the period of observation and, as a result, could not fairly be classified into either of the two sub-groups and have therefore been rejected. It will be seen from Table IV that the mean percentage of the time at risk which was lost through unauthorized absence is similar in both groups for each year. On the other hand, the mean percentage of time at risk lost through sickness absence is higher for the group of

TABLE IV

COMPARISON OF FREQUENCY DISTRIBUTION OF PERCENTAGE OF TIME AT RISK LOST THROUGH UNAUTHORIZED AND SICKNESS ABSENCE IN FACTORY 1 BY DISABLED MEN ON WEEKLY COMPENSATION AND "SETTLED" COMPENSATION

Percentage of Time at Risk Lost	Unauthorized Absence				Sickness Absence			
	Jan. 1-June 30, 1947		Jan. 1-June 30, 1948		Jan. 1-June 30, 1947		Jan. 1-June 30, 1948	
	Weekly	Settled	Weekly	Settled	Weekly	Settled	Weekly	Settled
No absence	8	17	5	13	13	22	13	26
0–	11	17	11	23	13	22	13	26
1–	3	10	6	11	1	1	—	3
2–	3	4	1	7	1	2	2	4
3–	—	1	1	2	2	2	1	5
4–	—	2	—	1	1	4	—	—
5–	—	1	—	—	—	2	—	1
6–	—	2	—	1	—	1	2	2
7–	—	—	2	1	—	—	—	1
8–	—	—	1	—	—	1	—	—
9–	1	—	—	—	—	—	1	1
10–	—	—	—	—	—	—	2	2
15–	—	—	—	—	—	1	—	—
20–	—	—	—	—	—	1	—	—
25–	—	—	—	—	—	—	—	—
30–	—	—	—	—	—	—	—	—
35–	—	—	—	—	—	—	1	1
40–	—	—	—	—	—	—	—	—
45–	—	—	—	—	—	—	—	—
50–	—	—	—	—	—	—	—	—
55–	—	—	—	—	—	—	—	—
60–	—	—	—	—	—	—	—	—
Total ..	18	37	22	46	18	37	22	46
Mean ..	1·36	1·74	1·80	1·45	1·36	2·40	4·40	2·75
Upper Quartile	2·0	2·0	2·0	2·0	1·5	4·0	6·5	3·5

disabled workers who were in receipt of weekly compensation than for the corresponding group who had "settled" their claim in 1948, but it is lower in 1947.

In this factory the number of occasions on which a man was late and the number of minutes late were also studied; but, for this purpose, only data taken in 1946 were available. These are presented in Table V.

The effects of a strike, which caused 32 of the disabled and 30 of the controls to be "late" for 150 minutes and one further man from each group to be late 420 minutes, have been neglected. The average number of days on which men were late was 3·3 in the year both for the fit and the disabled group. Of those who were late, the average number of minutes lost was 19·44 for the fit group and 24·96 for the disabled. There is thus no evidence that the disabled men were more often late, nor, when they were late, were they many minutes later than the controls.

TABLE V

FREQUENCY DISTRIBUTION OF DEGREE OF LATENESS OF DISABLED MEN COMPARED WITH CONTROLS IN FACTORY 1, JAN. 1-DEC. 31, 1946

No. of Minutes Late	Disabled	Controls
1–	111	106
30–	9	22
60–	1	2
90–	1	2
120–150	—	2
Mean No. of Minutes Late	19·44	24·96
Mean No. of Times Late	3·3	3·3
No. of Men	37	41

In Factory 3 only disabled men were studied. Their sickness absence in 1948 is given in Table VI.

TABLE VI

FREQUENCY DISTRIBUTION OF PERCENTAGE OF TIME AT RISK LOST THROUGH UNAUTHORIZED AND SICKNESS ABSENCE BY DISABLED MEN IN FACTORY 3, JAN. 1-JUNE 30, 1948

Percentage of Time at Risk Lost	Disabled	
	Unauthorized	Sickness
No absence	12	29
0–	18	30
1–	18	4
2–	2	2
3–	7	5
4–	7	1
5–	1	3
6–	—	2
7–	—	1
8–	—	—
9–	—	—
10–	—	3
15–	—	1
20–	—	—
25–	—	—
30–	—	—
35–	—	—
40–	—	—
45–	—	—
50–	—	1
55–	—	—
60–	—	—
65–	—	—
70+	—	—
Total	53	53
Mean	1·81	3·29
Upper Quartile ..	3·5	4·0
Percentage with Absence ..	77·4	45·3

By comparing Table VI with Table I it will be seen that both the means and the upper quartiles of the absence records are of the same order of magnitude. We may presume, therefore, that Factory 1, in which the more detailed investigation was made, was unlikely to be a special case in relation to the absence records of disabled men.

The absence records of all the groups of men studied in Factory 2 are given in Table VII (overleaf). When we compare the sickness absence records of the pneumoconiosis cases (" pneumoconiosis disabled ") with the corresponding group of fit men (" selected controls ") we find that the mean percentage of time at risk lost by the disabled men is almost twice as great as that lost by the control group. The significance of this difference was tested (see Table II) but it was found that a difference of this size could have occurred by chance. Thus, in this factory again, we find that the sickness absence rate of the disabled men did not differ significantly from that of the normal worker; but the groups observed were very small and the absolute difference in sickness absence between them was large. The small number, therefore, may have been the reason why this difference was not statistically significant.

The distributions of time lost through sickness absence of the pneumoconiosis cases were compared with a control group of other disabled workers (" selected disabled controls ") and it was found that neither the mean percentage of time lost nor the upper quartiles differed greatly.

Furthermore, the pneumoconiosis cases hardly differed in their sickness absence records from the group of other disabled workers (" disabled controls ").

It was therefore concluded that men with pneumoconiosis were not differentiated in Factory 2 in their sickness absence records from men suffering from other forms of disability. However, in order to test the notion that the insignificant difference between the absence records of pneumoconiosis cases compared with fit workers might have been due to the small numbers concerned, as discussed above, the absence records of the pneumoconiosis disabled men were combined with those of all other disabled workers (" disabled controls ") and the performance of the total disabled group obtained was compared with the performance of all the fit men. When this was done it was found that the disabled men had significantly more sickness absence than the fit workers (see Table II).

This procedure of combining the records of the pneumoconiosis cases with those of all other disabled workers cannot be fully justified; nevertheless, it does suggest that the insignificant difference found between the performance of the pneumoconiosis cases compared with the performance of the fit workers might well have been due to the small numbers in the groups.

The results obtained from the investigation in a Store Depot indicated that previous mining experience, apart from pneumoconiosis, was not a factor affecting absence from work. For it will be seen from Table VIII (overleaf) that the mean percentages of the time at risk lost by a group of ex-miners without pneumoconiosis compared with a control group of non-miners did not differ greatly; likewise, neither did the upper quartile distributions nor the percentage of workers who had periods of absence differ markedly.

Summary of Findings on Absence Data.—It may be convenient at this point to summarize the main findings from the absence data presented above.

In neither Factory 1 nor in Factory 2 were groups of pneumoconiosis cases found to have significantly more sickness or unauthorized absence than corresponding control groups of normal workers. In Factory 2 the sickness absence of the disabled men was greater than that of the fit men, but in Factory 1 the disabled men had actually less sickness absence over a period of three years.

A group of 53 men at Factory 3 had much the same absence records as the disabled group in the above factories, which suggests that neither of the two factories intensively studied were special cases.

Finally, we have the important observation that the mean percentage of time at risk lost through sickness absence by a group of certified men in three factories did not exceed 5 per cent. of their maximum working time and did not fall below 3 per cent., while the mean percentage of time at risk lost through sickness absence by control groups of normal workers in these factories did not exceed 5 per cent. and did not fall below 2 per cent.

Opinions of Employers.—Ninety-two replies were received from the questionnaires that were sent to the 150 firms in South Wales. Of these, 44 firms had had experience of employing men with pneumokoniosis.

It would be dangerous to attach too much meaning

TABLE VII

FREQUENCY DISTRIBUTION OF THE PERCENTAGE OF TIME AT RISK LOST THROUGH UNAUTHORIZED AND SICKNESS ABSENCE BY MEN DISABLED BY PNEUMOCONIOSIS AND BY CONTROL GROUPS OF NORMAL WORKERS AND OF MEN OTHERWISE DISABLED IN FACTORY 2, JAN. 1 TO JUNE 30, 1948

Percentage of Time at Risk Lost	Sickness Absence					Unauthorized Absence				
	Pneumoconiosis Disabled	Disabled Controls	Select Disabled Controls	Controls	Select Controls	Pneumoconiosis Disabled	Disabled Controls	Select Disabled Controls	Controls	Select Controls
No absence	15	40	16	75	20	17	56	18	76	22
0–	15	40	16	75	20	21	66	23	92	26
1–	1	2	—	4	1	5	6	3	3	—
2–	—	—	—	1	—	—	—	—	1	—
3–	1	4	—	4	1	—	—	—	2	—
4–	1	2	—	—	—	—	—	—	—	—
5–	1	—	—	3	1	—	—	—	—	—
6–	—	2	1	1	—	—	—	—	—	—
7–	1	5	3	2	—	—	—	—	—	—
8–	—	1	—	1	—	—	—	—	—	—
9–	—	—	—	1	1	—	—	—	—	—
10–	4	7	3	1	—	—	—	—	—	—
15–	—	7	3	2	1	—	—	—	—	—
20–	—	1	—	2	1	—	—	—	—	—
25–	1	1	—	—	—	—	—	—	—	—
30–	1	—	—	—	—	—	—	—	—	—
35–	—	—	—	—	—	—	—	—	—	—
40–	—	—	—	—	—	—	—	—	—	—
45–	—	—	—	—	—	—	—	—	—	—
50–	—	—	—	—	—	—	—	—	—	—
55–	—	—	—	—	—	—	—	—	—	—
60–	—	—	—	1	—	—	—	—	—	—
65–	—	—	—	—	—	—	—	—	—	—
No. of Men	26	72	26	98	26	26	72	26	98	26
Mean ..	5·15	5·02	4·52	2·31	2·22	0·39	0·24	0·35	0·27	0·12
Upper Quartile ..	7·5	8·0	7·0	1·0	1·0	1·0	1·0	1·0	1·0	1·0
Percentage with Absence	42·3	44·4	38·5	23·5	23·1	34·6	22·2	30·8	22·4	15·4
Total No. of Absences	15	43	15	32	7	10	20	12	31	3

TABLE VIII

FREQUENCY DISTRIBUTION OF PERCENTAGE OF TIME AT RISK LOST THROUGH UNAUTHORIZED AND SICKNESS ABSENCE BY EX-MINERS NOT DISABLED BY PNEUMOCONIOSIS AND BY A CONTROL GROUP OF NORMAL WORKERS IN STORE DEPOT, JAN. 1 - JUNE 30, 1948

Percentage of Time at Risk Lost	Sickness Absence		Unauthorized Absence	
	Ex-Miners	Controls	Ex-Miners	Controls
No absence	32	30	30	27
0–	32	30	37	32
1–	—	1	1	5
2–	1	2	1	2
3–	1	1	1	2
4–	—	—	—	—
5–	—	1	—	—
6–	2	1	—	—
7–	—	1	—	—
8–	—	—	—	—
9–	1	—	—	—
10–	1	3	—	—
15–	—	1	—	—
20–	—	—	1	—
25–	1	—	—	—
30–	1	—	—	—
35–	—	—	—	—
40–	—	—	—	—
45–	—	—	—	—
50–	—	—	—	—
55–	—	—	—	—
60–	—	—	—	—
65–	—	—	—	—
70–	—	—	—	—
75–	—	—	—	—
80–	1	—	—	—
Total ..	41	41	41	41
Mean ..	4·48	2·00	0·91	0·56
Upper Quartile ..	1·0	2·00	1·0	1·0
Percentage with Absence	22·0	26·8	26·8	34·1
Total No. of Absences ..	12	15	19	33

to the replies to the questionnaire. It is probable that many of the employers had never before considered their disabled employees to be a separate group. Their natural reaction to a request to do so, was to say that the disabled men were "quite satisfactory workers." Where the employer already had an opinion on this matter, his opinion was expressed in a more definite way.

The general tenor of the employers' opinions was found to be favourable. Employers were almost unanimous in the belief that, given certain conditions, disabled men were satisfactory workers. The conditions considered to be necessary were (i) that work must not involve heavy lifting; (ii) that there must be good ventilation in the shop; (iii) that heat, dust, damp, or fumes are undesirable.

Some quotations extracted from the replies to the questionnaire are given below, under the following headings: (*a*) comparison with normal workers; (*b*) loss of time by disabled men; (*c*) types of employment suitable for disabled men.

(*a*) A factory at Carmarthen employing 12 certified and 8 uncertified disabled men on general labouring duties:

"In the main, these men compare favourably with normal workers where employed in a dry atmosphere."

A factory at Pontypridd employing 9 certified and 1 uncertified disabled men on general factory operations:

"They compare very favourably. The employees concerned are industrious men, diligent, and have adapted themselves well to the various occupations which they have been set."

A factory at Hirwaun employing 7 disabled men as store-keepers, etc.:

"Favourable, i.e. the seven men working here have been placed where their particular disability would least affect them; also they are not severe cases."

A factory at Swansea employing 4 certified and 3 uncertified disabled men as general labourers and factory cleaners:

"They compare very favourably with normal workers. General opinion held by foremen of departments where these men are employed, is that they are good, willing workers, and that their disability does not interfere with the execution of duties. With the exception of three silicotics (two of whom are certified) who are more lethargic, all are equal to other employees doing similar work."

A factory at Treforest employing 3 certified and 1 uncertified disabled men as store-keepers and general labourers:

"They perform ordinary duties quite as efficiently as normal workers. The greatest handicap is that they are not able to lift any heavy weight, or even material weighing over a half-hundredweight."

A factory at Dinas employing 5 disabled men:

"Our observations from a limited experience would show that such cases are indistinguishable from normal workers employed upon light work and of temperamental equality. We have found that the incidence of absenteeism of a good type of man of these classes is no greater than any other worker, that he can perform any work which does not involve close contact with smoke or

fumes, or the bending and stooping involved in the lifting of heavy weights. We have further found it to be helpful that such men be offered work of such a nature and in such a manner that attention is not unduly drawn to any sense of a disability."

A factory in Porth employing 3 certified disabled men:

" The men referred to above are employed on machines which require standing up for eight hours a day, but no amount of physical strength. We would like to say most emphatically that these men show, in our opinion, a greater amount of keenness and interest in their work than normal men, and are most satisfactory employees in all respects."

(*b*) A factory at Carmarthen employing 12 certified and 8 uncertified disabled men on general labouring duties:

" The tendency is definitely more, for these men lose more time than a normal healthy person as far as this factory is concerned."

A factory at Pontypridd employing 9 certified and 1 uncertified disabled men on general factory operations:

" No noticeable difference from the general average. No wanton absenteeism. Average late-coming and sickness."

A factory at Hirwaun employing 7 disabled men as store-keepers, etc.:

" Varies with degree of disability, but generally fair."

A factory at Treforest employing 3 certified and 1 uncertified disabled men as store-keepers and general labourers:

" They perform ordinary duties with practically no loss of time, providing they are kept on light work. Any undue exertion will cause them to lose one or more days. Their record as far as absenteeism is concerned appears quite favourable, beside that of any of our other male employees. The time lost is practically nil."

A factory at Porth employing 3 men certified as cases of pneumoconiosis:

" In our experience, these men have never been late or guilty of wanton absenteeism. The only observation on this point is that if they do fall ill with ordinary colds, influenza, etc., they are absent from work for a much longer period than normal workers."

(*c*) Although the opinion of employers about what is suitable work for men disabled by pneumokoniosis is not necessarily medically valid, it is none the less of interest to record some of their opinions as examples of the attitude of some potential employers.

A factory at Carmarthen employing 12 certified and 8 uncertified disabled men on general labouring duties:

" The most suitable employment, in our opinion, is in a dry atmosphere where not too much movement is required and the handling is not of a heavy nature. We find that their opinion of what work they can do varies considerably. Some appear to work satisfactorily in all kinds of conditions, whereas others cannot, or will not, put themselves out. I believe a number could be more gainfully employed if they could get over the thought that they are permanently ill."

A factory at Aberdare employing 5 certified disabled men:

" To be engaged on work:—(*a*) not heavy; (*b*) not exposed; (*c*) not dusty. Generally speaking, more than usual normal employment procedure has to be adopted to suit specific cases."

A factory at Porth, employing 4 disabled men:

" Mobile employment or some movement desirable. Long runs of same type of work desirable."

A factory at Treforest employing 1 certified and 2 uncertified disabled men:

" We think that these types of workers want to be living near their work, and should not do long, damp journeys."

A factory at Pontypridd employing 1 man with pneumokoniosis:

" In this branch of industry (fancy goods), it should be possible to employ these men on general factory work, on winding machines, and if possessing natural dexterity, on knitting looms and other similar machines. Age, of course, plays an important part in deciding these questions. Our man is young, about 24 years old. An old man, with probably more infection, would not give such a favourable picture."

A factory at Treforest employing 3 certified and 1 uncertified disabled men as store-keepers and general labourers:

" Our experience as far as most suitable types of employment is concerned is limited, but we have found that, given reasonably good ventilation in a shop, and providing that the amount of lifting is not excessive, these men should be able to tackle most types of factory work."

Some further evidence on the comparative efficiency of disabled men was collected from

progress reports kept by a firm at Treforest. In this firm annual reports are made on each worker by his foreman and these reports are checked by the senior foreman. Marks are awarded under seven different headings:—

1.	Accuracy	10 marks	
2.	Efficiency	10 marks	
3.	Industry	10 marks	
4.	Adaptability ..	10 marks	Total: 100
5.	Loyalty	10 marks	
6.	Improvement ..	10 marks	
7.	General Impressions	40 marks	

These reports are used as a basis for promotion. The marks awarded to 24 disabled men and to 24 men in a control group were obtained. The results are interesting but inconclusive; the small numbers concerned and the subjective nature of these estimates obviously make caution imperative.

It was found that the average mark given to the control group was 68·6 and to the disabled group 65·5. There was a considerable difference in the distribution of the marks given under each heading and this distribution is shown in Table IX.

TABLE IX

DISTRIBUTION OF MARKS FOR PROGRESS OF MEN DISABLED BY PNEUMOCONIOSIS AND OF NORMAL CONTROLS

Range of Marks	Percentage of Disabled Men in Each Range	Percentage of Control Group in Each Range
1. Accuracy		
1–5	75	58
6–10	25	42
2. Efficiency		
1–5	64	37
6–10	36	63
3. Industry		
1–5	3	17
6–10	97	83
4. Adaptability		
1–5	66	58
6–10	34	42
5. Loyalty		
1–5	—	5
6–10	100	95
6. Improvement		
1–5	79	54
6–10	21	46
7. General		
20–30	100	55
31–40	—	45

The figures in Table IX are presented for what they are worth. If any conclusion can be drawn from them it is that, on this evidence, the disabled men in the factory seemed to be less accurate, efficient, adaptable and capable of improvement than those in the control group, but were more loyal and industrious.

CONCLUSIONS

Our investigation provides no information about the men more disabled by pneumoconiosis as they will not presumably be found in employment in factories. Nor does it permit us to say anything about the performance of the less disabled men when employed in any other circumstances than in light factory work. In light factory employment, however, it would appear from the quantitative and qualitative evidence presented that there is no reason to suppose that a group of men with pneumokoniosis would have much, if any, greater absence than a group of normal men. This conclusion, of course, may be subject to some considerable margin of error, for men with pneumoconiosis vary greatly as far as their physical disability is concerned. This fact makes generalization about the absence performance of the population of pneumoconiosis cases, as a whole, dangerous. This is particularly true when the small scope and selective nature of the data used in this paper are taken into account.

More confidence can be placed in the assertion that a group of less seriously disabled men will not be absent to such an extent that they will be differentiated by employers in this respect from the rest of their workers. This last conclusion is confirmed by the results of the employment questionnaire.

SUMMARY

The efficiency of ex-miners disabled by pneumoconiosis who were employed in light factory industry was assessed by comparing their absence records with those of control groups of normal workmen; and also by analysing the opinions of employers about the performance of the disabled men.

The absence records in two factories were studied intensively. In one of these factories which employed 37 disabled men in 1946, 60 in 1947 and 69 in 1948, it was found that both the sickness and the unauthorized absence of the disabled men did not differ significantly from the absence records of the control groups in these years. In the other factory, which employed 26 disabled men in 1948, a similar result was obtained. Absence records for disabled men in a third factory were similar to those

in the two studied intensively and this suggested that the latter were representative.

The conclusion was reached that it is improbable that a group of pneumoconiosis cases who obtain employment in light industry could or would be distinguished by their employers, as far as absence is concerned, from other normal workers.

The opinions of the employers about the performance of the disabled men in light industry were, on the whole, very favourable.

I wish to acknowledge the very great help and co-operation which I received, when obtaining the absence data, from the personnel managers of all the factories studied.

I am also indebted to Mr. Pierre Gutman of Columbia University and to Mr. P. D. Oldham of the Pneumoconiosis Research Unit for their help with the statistical analyses used in this paper.

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VARIATIONS IN ENERGY EXPENDITURE DURING WALKING

BY

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Wide individual variations exist in energy intake as food. Our own observations of the calorie values of the diets of Edinburgh University students (Kitchin, Passmore, Pyke, and Warnock, 1949), together with those of Cook (1948) on Dundee students and of Widdowson (1947) on middle class boys before the second world war, are shown in Table I. This table is indeed only a quantitative statement of the extent of variations already familiar to all those responsible for feeding young men. But, though the variations are well known, the factors responsible for them are not easy to determine. Those of the Edinburgh students, we think, cannot be accounted for entirely by differences in external work carried out. Thus the survey took place during the winter months when daylight was short and active outdoor exercise was limited to the week-ends. For five days of the week, at least, these students could with reason be classified as " sedentary workers ".

TABLE I

VARIATIONS IN DAILY INTAKE OF CALORIES BY HEALTHY YOUNG MEN

	Edinburgh students	Dundee students (Cook)	Middle-class boys (Widdowson)
Number surveyed	127	44	20
Age	19-21	17-31	18
Mean daily Calorie intake	2,970	2,878	3,427
Minimum daily Calorie intake ..	2,140	1,994	2,338
Maximum daily Calorie intake ..	4,690	3,595	5,221
Standard deviation	518	409	703
Coefficient of variation	17·4	14·4	20·4

However great the variations in physical activity at the week-end, it is hard to believe that this factor alone could account for the wide variations in food intake spread throughout the week of each survey.

The possibility exists that those who consume less food are more economical machines ; they can go " more miles to the gallon ". In carrying out a set piece of mechanical work these small eaters may need less energy than the big eaters. To test this hypothesis we have measured the variations in the energy expenditure of a group of 50 young men, half of whom had previously taken part in our diet survey, during the performance of a standard task. Walking at a fixed speed was chosen, as it seemed to be the one physical activity which must be common to all and in which all would be in daily training and practice.

Any successful correlation between the variations in individual energy intake and output might be expected to throw some light on the important nutritional and social problem of obesity. Although in the final analysis obesity is a simple disturbance of the balance of energy, the mechanism and causes of the upset of the balance are far from being fully understood. Obesity is the most important nutritional disease in Scotland to-day. Our colleague, Dr. Meiklejohn, tells us that, judging from his experience in the Dietetic Department of the Edinburgh Royal Infirmary, he guesses that out of the half million citizens of Edinburgh, at least ten thousand are so much overweight as to constitute a serious menace to health. Studies in variation of energy utilization may be basic to an understanding of the real cause of the disorders of these people, who, for the most part, cannot be dismissed as simple gluttons.

METHODS

Energy utilization was determined by indirect calorimetry using the Douglas bags and Haldane gas analysis apparatus (Douglas and Priestley, 1948).

Fifty male students from the physiology class acted as subjects. Their ages varied from 19 to 27, the average being 20 years 4 months. They formed a homogeneous group, and variations in height, weight, and vital capacity are recorded in Table II. Twenty-five had taken part in the diet survey previously reported (Kitchin and others,

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1949), and figures for Calorie consumption over a week were available. Unfortunately, the interval between the measurement of dietary intake and energy expenditure was 15 months.

For an assessment of basic energy expenditure, oxygen consumption was recorded in a resting condition. The routine of the observations was as follows.

Volunteers, with whom arrangements had previously been made, reported at 2 p.m. in the laboratory after the normal 1 to 2 o'clock luncheon break. After being weighed and measured, they rested, lying on a couch, for 30 minutes. Resting oxygen levels were determined between 2.45 and 3 p.m. The walking was then carried out on a paved outdoor track. The standard pace was 90 metres per minute (3·35 m.p.h.), and this was checked at 20 second intervals. No difficulty was found in maintaining a uniform speed. Expired air was collected over approximately three-minute periods.

All students then carried out the Harvard step test of physical efficiency (Brouha, Fradd, and Savage, 1944). In this the subject steps up and down 30 times a minute for five minutes on to a 20-in. stool or platform. This is a severe test. Those who cannot complete it are given an arbitrary assessment based on partial performance. Those who complete the test have an index allotted them on a scale based on measurements of pulse rates during the four minutes subsequent to the exercise.

Results

Table II shows the mean range, standard deviation, and coefficient of variation of all our observations. Fig. 1 is a scatter diagram on which are plotted the rates of oxygen utilization during a standard walk against previously determined Calorie consumption per day. The diagram shows no evidence of any correlation. Both sets of figures are uncorrected for size. We have attempted correlations between figures derived from these basic data in which corrections for size have been incorporated. However, we have been unable to derive any evidence of a relationship between the efficiency of energy expenditure and average food consumption. This, of course, does not mean that such a relationship may not exist. With our methods we have only been able to sample brief periods of behaviour for measurements. We can only conclude that such a relationship, if it exists, is not very close and, to demonstrate it, observations on a scale altogether greater than ours would be necessary.

Although the main result of these experiments is negative, certain subsidiary points of interest arise. In Fig. 2, variations in energy expenditure during

TABLE II

Physiological Variations (50 young men)

		Mean	Range	Standard deviation	Coefficient of variation %
Weight (Kg.)		66·9	55 80	6·8	10
Height (cm.)		174·9	162 189	5·7	3·3
Surface area (sq. metres)		1·81	1·60 1·98	0·090	4·9
Vital capacity (litres)		4·8	3·7 6·2	0·26	5·4
Harvard step test (arbitrary units)		73	40 105	15·0	21
Oxygen consumption (ml./min.)	Resting	270	209 345	28·1	10·4
	Walking	1,156	920 1,540	124	10·7
Resting metabolism (Calories/sq. metre/hr.)		42·9	33·9 52·2	4·75	11
Heat output during walking (gm. cal./kg./metre)		0·636	0·406 0·795	0·080	12·6

walking are plotted. The energy expenditure is calculated in gm.-calories per kilo bodyweight per metre, in line with the classic studies on energy transformation during horizontal walking by Benedict and Murschhauser (1915).

For the base line, estimations of resting metabolism after food have been taken. Although theoretically this is much less satisfactory than determination of basal metabolism, practical difficulties arise in measurements of B.M.Rs on a large scale. It is satisfactory, therefore, to find that our determinations for resting metabolism agree well with the findings of Cathcart and Orr (1919) on young infantry recruits. These observers found an average B.M.R. of 37·8 Calories per sq. metre per hour for the comparable group of young men. . The increase in lying rate after meals was found to be 12 per cent., giving a figure for a "resting metabolism" of 42·3, with which our figure of 42·9. recorded in Table II, agrees closely. Benedict and Murschhauser's observations are very detailed and precise, but cover only two subjects, both professional athletes. They found that a change from a lying to a standing position resulted in increases in metabolism of 9 and 10 per cent. respectively in the two subjects. Our calculations of heat output during walking are made after subtraction of the individual observed value for energy expenditure resting after food.

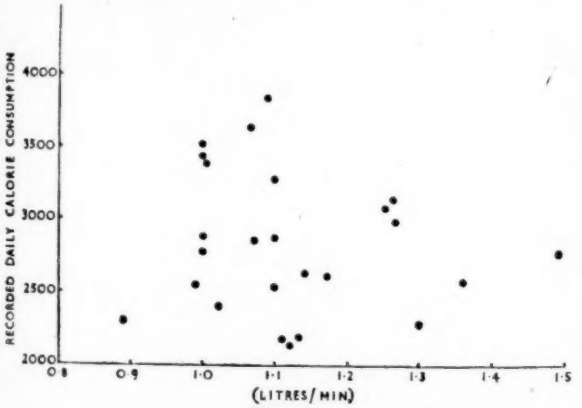

FIG. 1.
Oxygen utilization walking at 90 metres per minute.

The relationships between energy expenditure and weight and height are complex. A part of the work done in walking consists in raising the centre of gravity of the body at each step. In fact, in expressing energy during walking in gm. cal./kilo/metre, Benedict and Murschhauser assumed that with increasing weight an increasing expenditure of energy ensues. Our figures do not provide a complete justification for this assumption. The correlation between weight and the extra oxygen utilization on walking only gives a coefficient $r=0\cdot225$ and $t=1\cdot59$. This is not a significant degree of correlation, although it is suggestive. The reason for this is undoubtedly the complex relationship between weight and height and energy expenditure. With extra weight there is usually extra height, and this means longer legs, fewer steps, and less raising of the body. Unfortunately, we neither measured the length of legs of our subjects nor counted their steps when walking. Over the whole height range

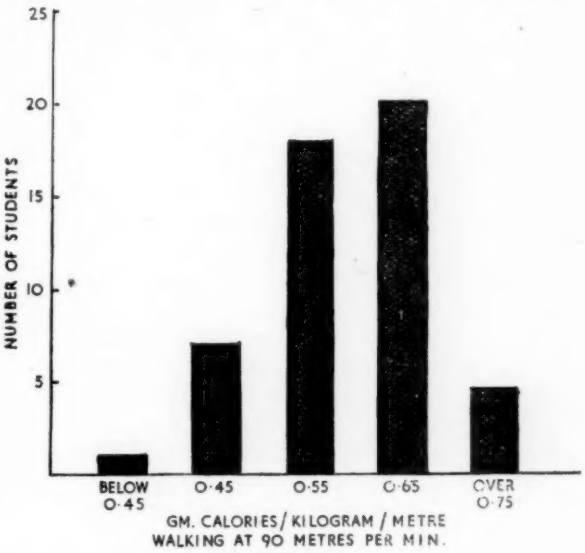

FIG. 2.
Variations in energy expenditure during walking.

our figures show no correlation between height and energy expenditure, but the small men were all above the average figure for energy expenditure expressed in gm. cal./kilo/metre. Thus nine men in the group with heights below 170 cm. (5 ft. 7 in.) had an average figure of 0·714, compared with the average of 0·621 for those over this height. The standard deviation of this difference gives a "t" value greater than 5, and the difference is statistically sound.

In walking, with increasing size, more weight has to be lifted but it does not have to be lifted so frequently. Thus size would appear to affect energy expenditure in two different directions. Our data make it clear that to work out the significance of these changes, observations on a series far larger than our present one of 50 would be necessary.

The degree of physical fitness might be thought to affect energy expenditure. Of our students, 23 gave Harvard step tests between 65 and 79 and were graded as average. Sixteen were above the standard, nine were below it, and two were considered unfit to take the test. The test is considered to

compensate automatically for variations in size, and no correlation between performance and height or weight has been found (Selzer, 1946). We found no correlation between the test and walking energy expenditure.

Conclusions

These observations on physiological variations in healthy young men emphasize the wide range of normality. We feel that these variations in energy expenditure may lie near the root of the problem of obesity and that these further data on their nature are valuable and perhaps provocative.

Our observations also re-emphasize the difficulties of drawing up satisfactory tables of dietary requirements based on estimations of energy expenditure on different types of work. For instance, the specimen daily tables of energy expenditure drawn up by Orr and Leitch (1937), and used for assessing Calorie requirements, rely for their data in many respects on intelligent guessing. Basic information is lacking. Hitherto such tables have, of necessity, dealt with a mythical average man. Food administrators drawing up ration schedules have perforce to think in terms of such an average man. Yet many normal men differ profoundly from the average man. With the increasing group control of individual activities in our society, it is important for the individual that the group should know how individuals vary. A wider study of such variations in energy expenditure in performing standard tasks would be a useful aid to practical planners. The classical methods both of direct and indirect calorimetry, although exceedingly precise in skilled hands, are so laborious and time-consuming that in practice metabolic studies have for the most part been limited to detailed observations on a few subjects. When newer methods of sampling expired air and fresh means of estimation of oxygen become available, it may be possible to extend the range of many of our basic observations over a much greater number of subjects, with a correspondingly greater increase in accuracy. This would enable much practical food planning to rest upon a sounder basis of scientific data.

Summary

The energy expenditure of 50 healthy young men was determined whilst walking under standard conditions. The mean value found was 0·636 gm. cal./kilo/metre, with variations between 0·406 and 0·795.

No correlation could be found between these variations and the previously determined dietary intake of calories.

The relation with variations in height and weight and in the Harvard step test for physical fitness is discussed.

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REVIEWS

Modern Trends in Public Health. Edited by ARTHUR MASSEY, C.B.E., M.D., D.P.H., D.P.A. 1949. London: Butterworth & Co. Pp. 581 + xi. (£2 10*s.* net.)

Dr. Massey has collected a first-class team and given them the task of expounding modern ideas and practice in public health. The twenty-three essays cover a wide field, and there can be no doubt that the book will become a standard work of reference for all interested in the development of public health, and especially for those about to take up preventive medicine. In no other book will the young medical graduate find such clear statements both of its aims and ideals.

The editor has experienced difficulty in arranging the chapters in any logical sequence, and so has fallen back on the expediency of sending in his contributors in alphabetical order. Under this arrangement the book starts badly, for Dr. K. E. Barlow, who opens with a chapter on "The Idea of a Family Health Club," devotes so much space to expounding elementary biology in a series of clichés that he has little room left to relate either what the Peckham Health Centre has achieved or the Family Health Club at Brandon Woods hopes to do.

In the second chapter, Dr. Fraser Brockington gives an account of "Nutrition and the Public Health." Into thirty-one pages he has packed a mass of accurate information about recent advances, covering biochemical studies, clinical observations, and administrative measures. No one can read this compact review without learning something both novel and interesting.

The third chapter, by Professor F. A. E. Crew, on "Social Medicine as an Academic Discipline," is one of the most important contributions in the volume. The whole history of the academic attitude to preventive medicine is depicted, starting from the writings of Johann Peter Frank (1745-1821) in Germany and a voluntary course given in Edinburgh in 1795 by Duncan *primus*, then Professor of the Institutes of Medicine. The evolution of ideas is illustrated by extracts from standard works of the past and by details of old courses of study for undergraduate and post-graduate instruction. The view is put forward that as an academic study social medicine has advanced but little since the days of the great Prussian liberal politician, Virchow. Preventive medicine in the universities was subsequently almost swallowed by the science of bacteriology. To-day in the universities it is in danger of becoming merely an adjunct to a renaissance of clinical medicine, now in revolt against excessive dependence on laboratory studies. As an independent university discipline, social medicine can only justify itself by studying and expounding how changing patterns of morbidity and mortality affect the structure of human society, and the use of medicine as an instrument of social policy. This interesting thesis appears to the reviewer to have a logical corollary. Of those future leaders of society who will determine the outlines of future social policy, only a small minority will pass through the medical faculties of the universities. Teachers of social medicine would thus be best advised to strive to teach their ideas to students of the humanities in the arts faculties.

In chapter four Dr. Robert Cruickshank gives a workmanlike description of "Recent Laboratory Contributions to Epidemiology." He reviews recent knowledge of the manner of spread of respiratory and intestinal infections, and gives a bibliography of one hundred references.

Dr. W. Edwards gives a delightful account of "General Practice and its Contribution to Preventive Medicine." This chapter should be reprinted and a copy sent to every general practitioner. Dr. Edwards writes pithily and is not afraid of an elegant digression. In an aside on the medical curriculum he hints that the general practitioners of the future might be better at their jobs if, instead of sitting at the feet of a professor of biochemistry, they took a course in the appreciation of fine art. This seems common sense.

In chapter six Dr. William Gunn gives a brief, clear account of "The Future Scope of Infectious Diseases' Hospitals and Associated Services" from the viewpoint of a medical administrator. Professor Johnstone Jervis follows with a forty page, well-documented and well-illustrated review of the smoke problem. This chapter will be a standard reference for many years.

Dr. Kershaw tells the story of "Public Health Nursing", beginning with an account of the Ladies' Reform Association in 1862, and looking forward to the workings of new legislation. The training of the health visitor of the future and the question of specialization is discussed at length.

"Chronic Rheumatism as a Public Health Problem", is discussed by Dr. G. D. Kersley, who gives an excellent account of the present position and a concise summary of orthodox views in Great Britain.

In chapter ten Professor Lane describes a scheme for the teaching of the principles of "Occupational Health in the Universities", both to undergraduate and post-graduate students. This chapter should be studied by every medical faculty and serve as a model to many. Professor Lane ends with a concise statement of the proper aims and objects of a student health service.

Chapter eleven, "The Contribution of Dentistry to the Public Health" by Dr. Lilian Lindsay, is an orderly, clear review of past accomplishments and future prospects.

Professor J. M. Mackintosh writes a brilliant chapter on "Housing and the Home—The New Outlook." He describes how houses can and must be built not only to satisfy basic physiological needs for shelter and to supply elementary sanitary appliances, but also to provide a proper stage upon which the social and artistic life of a family can unfold. This chapter is memorable for an elegant translation of an ode of Horace, a thing of beauty in itself and pat to the argument.

In chapter thirteen Dr. A. A. E. Newth describes the "School Health Service", and in chapter fourteen Dr. Doris M. Odlum writes on "The Mental Health Aspect of Public Health". Both these chapters seem model accounts of present services and their aims and achievements.

In a chapter on "Health Centres in their Relation to Social Medicine and Public Health" Dr. R. H. Parry discusses the role of health centres in the new public services. He describes existing centres and gives details of administration and structural lay-out.

Sir Leonard Parsons in a chapter on " Child Health and the Universities " gives a fine account of how a university must train its graduates both in preventive paediatrics and in the care of sick children. Those whose task it is to build paediatric courses in new universities and those who must renovate old methods of teaching will both find knowledge and inspiration here.

The seventeenth chapter, by Dr. Hugh Paul, gives a fascinating description of the scope of modern day nurseries and the responsibilities of their medical staff.

In chapter eighteen Dr. Donald Stewart gives a brilliant statement of the role the doctor can play in promoting occupational health. All medical men who are considering entering the industrial field should not fail to read this. In it they will find an account not only of the duties and responsibilities of an industrial medical officer, but also of the wide variety of interesting problems which they are likely to meet.

Chapter nineteen on " Vital Statistics—Modern Developments " by Dr. Percy Stocks, and chapter twenty on " Health Education " by Dr. Robert Sutherland, are disappointing. Or was one surfeited by good things at this stage ? Dr. Stocks can never be either dull or uninformative, but this chapter seems unnecessarily discursive and it is not quite clear what it is all about. Most readers of this book will be in agreement with Dr. Sutherland about the need for health education, and would probably have preferred more detailed discussion of the scope and technique, rather than generalizations about aims and objects.

In chapter twenty-one Dr. Normal Tattersall deals with " Tuberculosis—the Present Position ". Statistics and epidemiology, B.C.G. vaccination, chemotherapy, radiology, tuberculosis services, rehabilitation, and the tuberculosis colony, these are all taken in order. The story is brilliantly told, and this is perhaps the most exciting chapter in the book.

Dr. H. C. M. Williams on the " Health Control at the Ports " and Dr. G. S. Wilson on the " New Organization of Public Health Laboratory Services " bring up the rear. Both give clear and workman-like accounts of these very important organizations.

If this review is so overloaded with superlatives that it makes bad reading, this cannot be helped. The superlatives must stand. It is hoped that they will convey that within the covers of this book is to be found an account of the ideas and institutions of modern preventive medicine in Great Britain. Many of the chapters are brilliant examples of hard thinking and clear writing: all are authoritative and informative. The reader will find here the basis on which public health teaching and services will develop not only in Great Britain, but probably throughout the world.

The production of the book is of the standard that we have been lead to expect from the house of Butterworth.

R. PASSMORE

Women's Occupations through Seven Decades. By JANET N. HOOKS. Women's Bureau Bulletin No. 218. United States Govt. Printing Office. Washington. 1947. Pp. 260. Price 45 cents.

This Bulletin traces the history of women's work in the United States of America during the past seventy years. The author describes in great detail the labour trends in about 450 different occupations. Between 1870 and 1940 the number of women at work increased from under two million to over 13 million and their ratio to all workers changed from 1 in 10 to 1 in 5. During the last war, from 1940 to 1945, the number rose to 20·6 million, but quickly dropped again after the end of hostilities to just over 16 million.

In 1940, out of 51 million women over the age of 14 in the United States, 11½ million, or 25 per cent., were in work, half a million were in public emergency work, and one million were seeking employment. At the same time, 80 per cent. of all adult men, or 40 million, were working. Miss Hooks rightly points out that the unpaid work of the housewife in her own home should be included in any survey of women's occupations, and states that, if those engaged in housework are included, over four-fifths of all women contributed " to the well being of the nation through either paid or unpaid work."

The sex ratio shows that only in domestic service do women account for more than half the workers, and in this occupation they reach 93 per cent. of the total. Only in the professions (47·4 per cent.), clerical, sales and kindred workers (42·0 per cent.), and service workers other than domestic (44·8 per cent.) do they account for more than a third, whereas in all others their proportion varies from 2 per cent. of all craftsmen and industrial supervisors to 25 per cent. of all industrial workers. In America, as in this country, the textile and allied trades absorb a large number of working women, and in 1940 54·5 per cent. of all employed women were to be found in textile manufacture, and the making of wearing apparel and fabricated textile goods.

The first year in which occupational returns were made for women was 1870. In 1930 the group " home workers " (housewives) was included for the first time. The actual number of occupations reached a peak in 1920, when 572 separate jobs were listed. In the subsequent amalgamation many obsolete occupations were abandoned, so that today we find no mention in the labour returns of such persons as " mantua maker ", " daguerreotypist ", or " hoop skirt maker ". Others have lost their identity as, for example, " curriers ", " tanners ", and " morocco dressers ", who are now all lumped together as " operatives in leather goods ".

The group of " clerical, sales and kindred workers ", who numbered only 13,000 in 1870, by 1940 had reached the staggering total of 3½ million, including over a million stenographers, typists, and secretaries. Women still account for only 54 per cent. of all " office workers ", which indicates that they have not replaced men in offices so much as grasped new opportunities. The high social status enjoyed by the " white-collar " occupations has made them especially attractive to women. A meteoric rise has also been observed among the group of " barbers, beauticians and manicurists ", who increased by 240 per cent. between 1920 and 1930. This, with the expansion of the amusement industries, is a reflection of the American post-war boom which continued throughout the 'twenties.

The census definition of a " professional " worker has been adopted as one who " performs advisory, administrative or research work, which is based upon the established principles of a profession or science, and which requires professional, scientific or technical training equivalent to that represented by graduation from a college or university of recognized standing." Semi-professional workers are those in " a restricted field of science or art, qualified by training or experience or both." In 1940 there were 1½ million women in these groups, of whom the two professions of teaching and nursing absorbed 75 per cent. Law, medicine, and theology accounted for less than 1 per cent. of this group, whereas they included nearly a quarter of all professional men. " Teaching has always been the outstanding

professional occupation for women," and in 1940 72 per cent. of all teachers were women. Between 1870 and 1940 the number of women employed in this field increased tenfold, due, it is suggested, to the widespread replacement of men by women during the Civil War, which placed teaching "overwhelmingly in the hands of women." The number of nurses returned rose from 1,154 in 1870 to over 360,000 in 1940.

The first American woman doctor qualified exactly a hundred years ago, and by 1870 there were 544 women physicians and surgeons. In the 1940 census the number returned was 20,671, which included "physicians, surgeons, osteopaths, chiropracters and healers and medical workers (not elsewhere classified)". The report points out that in the medical and quasi-medical occupations there has been an increasing domination of the field by the semi-professional workers such as physiotherapists, masseurs, and chiropodists, and a relative decline in the professional physicians group. In the legal profession, although a good many women take their qualifying examinations, a large number do not practice or else use their legal training as auxiliary in some other profession. Hence census returns are unreliable and always an underestimate. An amusing note relates to the profession of "aviator". In 1910 they were classed as "showmen," and as late as 1940 only 51 women followed this profession—a reflection on the small demand for their services as paid pilots.

Many more married women go out to work now than formerly—15 per cent. in 1940 compared with only 6 per cent. in 1900. They are chiefly to be found in the occupations of domestic service, saleswomen, laundry hands, boarding-house keepers, waitresses, and textile workers.

Almost every conceivable occupation is listed, analysed, and related to all the others, and the history of the more important industries in terms of labour force is traced from the late nineteenth century to the present day. The author shows considerable insight into the reciprocal influences of occupation and living habits.

It is a matter for regret for the non-American reader that so little information is given about the non-white or negro worker. Barely a page is allotted to this subject. Only 14·4 per cent. of women in all occupations in the experienced labour force were non-white, of which two-thirds were found in public and private housekeeping, in which occupations they constituted nearly 40 per cent. of all those employed.

There is a good, selected bibliography on the employment of women, and statistical tables showing decennial employment figures for every occupation or group of occupations from 1870 to 1940. A useful list of current publications of the Women's Bureau is appended. As a work of reference this bulletin is valuable provided its limited scope is appreciated. We have nothing comparable to it for women workers in Great Britain.

CATHERINE SWANSTON.

Haven Products: A Scottish Experiment in the Employment of Severely Disabled Men. By A. E. TURNER, T. A. STIRRAT, and T. FERGUSON. 1948. Published by the Nuffield Provincial Hospitals Trust. Pp. 27. No price given.

The complex interrelationship of the occupational *milieu* with community health is illuminated by this Report. It was during the industrial depression of the 1930s that the Scottish Industrial Estate at Hillington came into being. It was a non-profit-making company set up on a Treasury grant, the tenants working under ordinary competitive industrial conditions whilst availing themselves of the services and amenities provided by the Estate Company at an economic rent. On this Estate in 1945 the Haven Products set up a sheltered workshop which became the laboratory for a socio-medical experiment in collaboration with industry.

The problem of employment of the severely disabled had long vexed the minds of medical and social service staffs at Glasgow, and it was recognized that there were many categories of disablement which must prevent resettlement in purposeful, satisfying, remunerative occupations unless a special environment were created. It was decided, therefore, to set up a workshop to employ fifty disabled persons with the possibility of subsequent expansion and perhaps the provision of outwork for the housebound centred on the factory. The industrialists on their part accepted the principle of community responsibility for such disabled persons, and the sheltered workshop came into being as a memorial to those who had fought in the cause of freedom. A sub-contract on favourable terms was secured for an initial period of three years from a firm engaged in the manufacture of electrically heated pads and blankets. The capital required was subscribed by the tenants on the Estate together with contributions from a number of voluntary societies and private individuals, and in 1946 a company was incorporated under the name of Haven Products Limited as a private company to provide facilities for persons registered under the Disabled Persons (Employment) Act, 1944, to have employment and to manufacture electro-thermic quilts, etc.

A Medical Advisory Committee was brought into being and arrangements were made whereby every disabled man employed would be medically overhauled. Medical supervision was kept as far as possible in the background and the enterprise was run along ordinary industrial lines. The various jobs to be undertaken in the manufacturing process were analysed and the requirements for each were made known to the Medical Advisory Committee which was responsible for personnel selection.

A wide variety of ingenious contraptions was devised to enable the disabled to cope with their work and with their machines. Training allowances for a twenty-six-week period were obtained through the Ministry of Labour, and thereafter a basic wage of 2s. 1½d. per hour was paid. A five-day week was adopted, and recruits were nominated by such bodies as the Cripples League, the Red Cross Treatment Centre, the City Hospitals, and the Ministries concerned. The British Red Cross undertook to provide twenty houses nearby for ex-servicemen, and since it is recognized that housing is the cornerstone for any scheme for the severely disabled it is hoped in the immediate future to obtain the means whereby similar houses for the civilian disabled will be provided. For the time being transport was provided to convey the workers to and from home.

During the first two years forty-eight men were employed, most of them very severely disabled: some with severe gunshot wounds of the head or of the spine or suffering from organic disease of the nervous system, some having lost a leg, a few having lost both.

The overall absence of workers from all causes amounted to some 7·5 per cent. of the total number of working days. The output of the workshop was low in the early months, as would be expected, but the curve rose gradually to reach a figure of about seventeen production units per man per day.

The best testimony to the value of this endeavour is the

striking change that is taking place in the men themselves. There has developed a happiness and enthusiasm and a sense of corporate life that is quite unmistakable. Failures were exceptionally few, being found among those who had difficulty in adapting themselves to their disabilities or those who suffered from diseases which were overwhelming in their manifestations.

This pioneer venture well merits the attention of those who are concerned with community health and who cling to the view that in medicine final social resettlement is the end of therapy. F. A. E. CREW

Studies in Air Hygiene. R. B. BOURDILLON, O. M. LIDWELL, and J. E. LOVELOCK, with W. C. Cawston, L. Colebrook, F. B. Ellis, M. van den Ende, R. E. Glover, A. M. MacFarlan, A. A. Miles, W. F. Raymond, E. Schuster, and J. C. Thomas. Medical Research Council Special Report Series No. 262. H.M. Stationery Office. London. Pp. 356. (Price 7*s.* 6*d.*)

At least a generation has grown up in Britain in an environment in which the bacterial purity of the water and food supply has been assured by the application of hygienic methods and controlled by statutory regulations. The benefits to health have been immense and several once common diseases have become, as a result, comparative rarities. No comparable advance has been made in air hygiene. Two technical reasons are probably responsible for the delay. First there is a much greater quantity of air requiring control than of food and water. Secondly, the majority of micro-organisms responsible for air-borne infections will not grow on agar plates, the corner stone of all research on the purity of food and water. This report describes basic experiments in air hygiene, which should foreshadow practical advances comparable with those at the end of the last century in water and food hygiene. It covers seven years' work by a team of research workers at the National Institute of Medical Research, Hampstead, begun in 1939 under the captaincy of Sir Patrick Laidlaw, carried on under Dr. C. A. Andreas, and completed and expounded under Dr. R. B. Bourdillon. The report is a model of what a well-integrated research team can accomplish.

Part I deals with methods of sampling air for bacteria, a difficult bacteriological problem. There is the implication that air either free from, or heavily contaminated with, bacteria is probably correspondingly either free from or heavily contaminated with pathogenic viruses. Until precise methods of detecting viruses in air become available, this must remain a hypothesis. Nevertheless, it is an assumption on which practical policy can be profitably based. Parts II to V deal with air disinfection by chemicals, by ultra-violet radiation, by heat, and by recirculation through filters. Part VI discusses the use of masks. There follow accounts of field trials in a city hospital, in operating theatres, in a dwelling house, in factories, on a cruiser, and on a submarine. Animal tests with infective aerozols are described Finally some general conclusions are given. The findings are not as yet sufficiently clear-cut or concise to be summarized in a few sentences in a review.

This report demands careful reading and study by all interested in the prevention of upper respiratory diseases. The many authors must be congratulated on the clear manner in which much difficult technical matter has been expressed. There can be little doubt that many of the findings will have far-reaching results on the health of the people.

Catalogue of an Exhibition of Books, Manuscripts and Relics commemorating the Bicentenary of Edward Jenner (17 May, 1749-26 January, 1823). 1949. Oxford University Press, Geoffrey Cumberlege, London. (2*s.*)

This catalogue of an Exhibition organized by the Wellcome Historical Medical Museum contains an excellent bibliography of early works on smallpox and vaccination and much other useful information. It will be invaluable to anyone starting a study of the history of smallpox or of infectious diseases in general.

ABSTRACTS

(This section of the JOURNAL *is devoted to selected abstracts of articles on social medicine appearing in the current literature. The section will be edited in collaboration with the two abstracting Journals,* Abstracts of World Medicine, *and* Abstracts of Surgery, Obstetrics and Gynaecology.)

Minimal Pulmonary Tuberculosis. Its Significance in Relation to the Age of the Patient. CHANG, R. (1948). *Amer. Rev. Tuberc.*, **58**, 612.

This study of minimal pulmonary tuberculosis consists of an analysis of 164 cases in patients admitted to Rutland State Sanatorium, Massachusetts, U.S.A., between 1938 and 1945, all of whom were followed up for at least two years. The diagnosis of activity depended on the presence of demonstrable changes in serial radiographs, of tubercle bacilli in the sputum, or of both; with an adequately persistent search, tubercle bacilli were found in 90·7% of the 119 clinically active cases. Each case was classified according to the character of the lesion, 20 being described as " recent infiltrates ", 41 as " fibroid minimal ", and 103 as " mixed ". Early infiltrates were found mainly in young patients, fibroid minimal lesions more often in older people—the majority of the latter probably having had tuberculosis long before the diagnosis was made. Of the mixed type, 47% were below 25 years of age, 39% between 25 and 38, and 17% over 38. All the cases with persistently negative sputum belonged to the apparently exudative and rapidly resolving type, which is possibly sometimes of doubtful aetiology.

The author found that neither the erythrocyte sedimentation rate nor a " shift to the left " could be relied upon to give evidence of activity in minimal lesions. An analysis of symptomatology suggested that in older patients the presence of symptoms is of less importance in determining the activity of a lesion than in younger patients, although their absence in the former strongly suggests inactivity. Conversely, in the younger patient any symptom should be carefully evaluated and the absence of symptoms in such a case should never be regarded as evidence of inactivity. The percentage of active cases was 88·9 in the group below 25 years of age, 71·7 in the intermediate age-group, and 48·8 in the group above 38; progressive disease also occurred more often in younger patients. Despite apparently very adequate hospitalization, the disease became reactivated after discharge in 17 of the 119 clinically active cases. It is argued that immediate hospitalization of the younger patient—but not necessarily of the older patient—is justifiable on diagnosing minimal pulmonary tuberculosis.

J. V. Hurford

Results of Active Diphtheria Immunization with Reference to the Duration of Immunity. (Ergebnisse aktiver Diphtherieschutzimpfung im Hinblick auf die Dauer der Immunität.) PASCHLAU, G. (1949). *Z. Hyg. InfektKr.*, **129**, 42.

A review of the relevant data recorded by non-German workers is supplemented by a survey of the anti-diphtheria campaigns in the pre-war Reich, where a steady rise in the incidence and mortality rate from diphtheria, despite the fact that many millions of children were immunized on a voluntary basis, occurred in the 1937 to 1941 period. To answer the question whether compulsory immunization reduces the incidence of and mortality from diphtheria, and to ascertain the minimum duration of the immunity evoked by active immunization, an analysis is given of the data obtained in the urban district of Göttingen and five adjacent rural sub-districts where, during five years, 15,598 children of pre-school and school age were inoculated; in addition, the incidence of and mortality from diphtheria were noted among 1,973 non-immunized children in the same area. Among the immunized children no deaths occurred, and 162 individuals developed diphtheria (1%); there were 16 deaths among the non-immunized children, (0·81%) out of a total of 160 diphtheria cases (8%); the ratio of incidence among the immunized to that among the non-immunized was during 1942, 1943, 1944, 1945, and 1946, 1 : 38, 1 : 11, 1 : 8·3, 1 : 10, and 1 : 8·7 respectively. Further analysis showed that active immunization protected for at least 5 years 99% of children of all ages, living in an environment where they were constantly exposed to the danger of diphtheria infection. *H. P. Fox*

Rheumatic Infection in Childhood: Fifteen to Twenty Year Follow-up. Caution Against Early Ambulant Therapy. ASH, R. (1948). *Amer. J. Dis. Child.*, **76**, 46.

A series of 331 rheumatic children was followed up for 15 years after the onset of the infection, and 150 children for 20 years after onset. At the end of 15 years, 55·9% were leading a normal existence, 4·5% were limited in activity, and 37·4% had died of rheumatic infection or bacterial endocarditis. Of the 150 children who were followed up for 20 years, 52·6% had died, 41·3% were leading a normal existence, and 3·3% were suffering from congestive heart failure. (According to the table 55·3% have died.) The incidence of carditis and of deaths within the first 10 years was greater among those taken ill during the period 1923 to 1927 than during the years 1928 to 1932, and least of all among those taken ill during the years 1933 to 1937. The author argues that the more prolonged period of rest in bed employed in recent years is a more important factor in this improvement than spontaneous changes in the character of the disease. (Spontaneous changes in the character of diseases due to infections are so important that it is never wise to make deductions about the effect of treatment by comparing the mortality rate in one period with that in another.) *R. S. Illingworth*

Report of a Survey of Children Born in 1941 with Reference to Congenital Abnormalities Arising from Maternal Rubella. PATRICK, P. R. (1948). *Med. J. Aust.*, **1**, 421.

For 129 children born during 1941 in Queensland, Australia, and whose mothers had rubella during the pregnancy, clinical findings of deformity and the period of pregnancy at which rubella occurred were tabulated.

Of these children 59 were affected, the commonest abnormalities being in order of frequency deaf-mutism, heart disease, mental deficiency, and cataract, singly or in combination. The grade of deafness is recorded. The following suggestions are made. Rubella should be notifiable. Girls might be deliberately exposed to the disease. Pregnant women exposed to rubella should be treated with immune globulin, although contact of pregnant women with cases of rubella should be avoided as far as possible. Termination of pregnancy should be considered if rubella is contracted in the first 4 months. Treatment is limited to education of deaf and mentally defective children. *Bernard Freedman*

Maternal Rubella and Congenital Defects. Data from National Health Insurance Records. HILL, A. B., and GALLOWAY, T. MCL. (1949). *Lancet*, **1**, 299.

The authors set out to assess accurately the frequency with which congenital abnormalities appear in the child when rubella or measles has occurred during pregnancy. With the help of several approved societies they traced employed insured women who presented a sickness certificate for one or other of these infections, and who, within 12 months, applied for maternity benefit. During a period of 2 years 22 notifications were made of such cases, but two of these patients, in whom infection occurred 2 and 3 months before conception, could not be traced. In ten cases the details obtained by questioning of the mother suggested that the illness was rubella and in six others measles was diagnosed. In the former group the illness was estimated to have occurred in the second month of pregnancy in two cases, second or third in three cases, third or fourth in two cases, at the sixth month in one case, at the eighth month in one case, and one month before conception in one case.

In all, 17 children were examined, of whom only one presented an abnormality (patent interventricular septum). The mother of this child had rubella at the end of the first month of pregnancy. Examination of one child, whose mother insisted that the baby was normal, was refused; the two other children in the total series of 20 had died at 7 days and 5 weeks respectively and in both cases the cause of death was recorded as pneumonia. The mothers had had rubella at the sixth and at the second month respectively.

The true frequency of the occurrence of congenital defects after infections in pregnancy can only be assessed by first observing the mother during the illness and later noting the condition of the infant, but, as the authors point out, the difficulties of such an inquiry are considerable and even in the space of 2 years very limited information has been obtained from records. In their view there should be compulsory notification. They conclude that their method lends itself to investigations of this type, and suggest that there should be very little delay in carrying out an examination of the child, in case death supervenes. Subsequent visits would probably be necessary. *T. Anderson*

On Sterility in Finnish Women with Special Reference to its Causes and Prognosis. [In English.] VEHASKARI, A. (1948). *Acta obstet. gynec. scand.*, **28**, Suppl. 5, 1.

The author presents a detailed analysis of 1,690 cases of sterility in Finnish women with particular reference to cause and prognosis. This publication contains no new ideas or methods, and is mostly confined to results derived from statistics only. [Some of this statistical material is based on methods of examination which would not be considered complete by present-day standards in English fertility clinics. Thus insufflation (presumably of gas) was carried out in only 164 cases, and no special examination, other than a simple clinical one, was made in 743 out of a total of 1,690 cases seen. Statistical analysis based on such material—only 821 patients had a hysterosalpingography—might well give misleading results, since the author does not appear to be acquainted with recent work on the psychiatric causes of tubal spasm. Thus cases are quoted in which male fertility has not been assessed, showing a higher percentage of tubal factors in the aetiology than in cases in which it has been assessed. A psychiatric cause might well account for some of this difference.]

The author finds that, of 595 cases of secondary sterility, more than half occurred after abortion. In general the male was the cause in 20%. The age of highest fertility in women was between 22 and 23 years; the average age of women attending his clinic was 32. [This is higher than in most reports published elsewhere.] His analysis shows that 55% of women attending with primary sterility had passed the age of optimal fertility. The average age of onset of menstruation was 14·7 years, and he concludes that the later the menarche the worse the prognosis. An analysis of his findings is given in the following table:

	Primary Sterility		Secondary Sterility		Total	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
1. Vaginal factors ..	25	2·3	2	0·3	27	1·6
2. Uterine ,, ..	37	3·4	36	6·1	73	4·3
3. Tubal ,, ..	427	39·0	341	57·3	768	45·4
4. Endometriosis ..	101	9·2	42	7·1	143	8·5
5. Genital insufficiency	389	35·5	109	18·3	498	29·5
6. Miscellaneous or unknown factors ..	116	10·6	65	10·9	181	10·7

[There are some curious omissions in this analysis. The author does not mention (page 29) faulty sexual technique as a cause of sterility, yet it is frequently observed in fertility clinics that because of ignorance penetration often has not taken place. Also (page 34) he considers anatomical retroflexion a cause of sterility—a view not generally accepted in Britain. Psychiatric factors should not be excluded, nor should that group of cases in which pregnancy occurs before any treatment is actually started. It is believed that emotional tension producing tubal spasm may be the causative factor, and that a visit to the doctor relieves that tension. It is clear that the author accepts the radiographic appearance of a tube as final, but recent observations have shown that repeated hysterosalpingography may demonstrate the presence of patency in a tube at first apparently blocked. No account is given of artificial insemination, and it is clear that this method of treatment has not been widely used. In general, although this paper is very carefully worked out, some of the results may be misleading because of the inadequacy of the investigations undertaken.]
B. Sandler

Causes of Error in Statistics of Sterile Marriages. (Causas error en estadisticas de parejas estériles.) GUERRERO, C. D. (1948). *Ginec. Obstet. Mexico*, **3**, 107.

In a study of 438 sterile marriages in Mexico the author found that successful results were obtained from treatment in only 10·1%, and that the percentage was not

increased with more experience and better methods. A detailed analysis of 100 cases studied in 1945 has therefore been made. There were 74 cases of primary sterility and 26 of secondary sterility. The average age of the patients was 28·6 years, and the average period of sterility 5·4 years. Thirty-nine patients were referred by other doctors, and 63 had been previously treated. A full investigation of the wife by modern methods, and of the husband, as far as possible, was carried out.

The four main factors causing sterility may be classified as tubal, hormonal, cervical-spermatic, and pure spermatic. Cases may be further divided into serious and not serious. The serious cases are difficult to treat or incurable, and include those of azoospermia, bilateral absence or obstruction of the tubes, and non-secreting endometrium. In 64 serious cases the success rate was 4·56%, in 24 not serious cases it was 41·8%, and for the whole series 14·5%.

The specialist in sterility problems has sent to him many difficult cases which have already had treatment and are often incurable, and unless this is sufficiently understood the speciality will lose prestige. Comparison of the results of methods of treatment is also impossible without a standardized classification such as that described. *Bryan Williams*

Habitual Abortion. A Pathologic Analysis of 100 Cases. WALL, R. L., and HERTIG, A. T. (1948). *Amer. J. Obstet. Gynec.*, **56**, 1127.

The authors make a well-timed appeal for a more rational treatment of habitual abortion according to the cause shown by systematic examination of mother, ovum, and placenta. Of 100 cases, 58 were found to have the same aetiology, the commonest factors being pathological ova (36 cases) and uterine abnormalities (8 cases); the least common factors were foetal anomalies (2) and inflammatory conditions (3). In a control series of 1,000 spontaneous abortions the aetiological factors were discovered in approximately the same percentages, leading to the conclusion that any woman who aborts is a potential habitual aborter, and the corollary that the first abortus of any patient should be thoroughly examined pathologically, to enable patient and physician to become "intelligently prepared" for a subsequent abortion. This evidently entails a belief in "specific" therapy, such as the use of endocrines in apparently forestalling the production of pathological ova, and of vitamin E in preventing foetal anomalies. [The latter, occurring in only 2% of the habitual abortion series, are worth remembering.] *A. F. Anderson*

The Incidence of Eclampsia in Wartime. (De frequentie van eclampsie in oorlogstijd.) MASTBOOM, J. L. (1948). *Ned. Tijdschr. Geneesk.*, **92**, 3604.

Statistical evidence collected in Amsterdam confirms the findings of other workers in other parts of Holland, emphasizing once again the decrease in incidence of toxaemia of pregnancy in wartime. To meet a well-known objection, the higher frequency of eclampsia in primiparae is taken into account, without altering the final conclusion. An analysis of data obtained in various belligerent countries during the first and the second world wars shows that the decrease in incidence is fairly constant. There is still a heated controversy as to the reasons for this lower incidence, and various causes, such as low salt or low protein consumption, were indicated. A closer analysis of the diet of pregnant Dutch women during the war years shows that, though the total Calorie intake was reduced, no single nutritional factor was particularly deficient. The author believes that the over-all low food intake is the cause. In support of this hypothesis he mentions another significant fact: a fall during the war years in the average blood pressure, affecting also pregnant women (I. S. Sindram, 1943, *Ned. Tijdschr. Geneesk.*, **87**, 1414). A low blood pressure indicates a lower vascular tonus, and it is suggested that a variation in the tonus affects the irrigation of the intervillous spaces—an important factor in the development of toxaemia of pregnancy. *A. Lilker*

Diet Studies in Pregnant Patients. DIECKMANN, W. J., TURNER, D. F., MEILLER, E. J., STRAUBE, M. T., GROSSNICKLE, K. B., POTTINGER, R. E., HILL, A. J., SAVAGE, L. J., FORMAN, J. B., PRIDDLE, H. D., BECKETTE, E. S., and SCHUMACHER, E. M. (1948). *Obstet. gynec. Surv.*, **3**, 731.

The authors began their present study of the diet of pregnant women in September, 1946, and it is still being continued; it is hoped that eventually the investigation will include 1,000 patients. The present report is a preliminary one and describes the methods used to secure an accurate dietary record during pregnancy. No attempt has yet been made to study the effect of a controlled diet on pregnancy, but it is hoped that eventually the results of these investigations will be pooled with those of other institutions and definite conclusions reached, based on an adequate number of patients.

Each new patient seen within the first 4 months of pregnancy is interviewed by a dietitian and provided with a 500 g. scale, which she is taught to use. She is then asked to keep a complete record of everything eaten until the next visit 2 weeks later. At the second visit a diet is recommended containing 85 g. of protein with the other constituents in appropriate amounts. For the remainder of pregnancy she is asked to weigh and record her food intake during five or six 2- or 3-week periods. All patients are instructed initially to take a basic diet of 1,800 Calories, but if gain in weight is excessive the caloric intake is reduced to 1,500 or 1,200. Laboratory and clinical data are being recorded on these patients, but only the protein intake of the diet is being calculated. Records, however, will be available for calculation of all the minerals and vitamins. Up to December, 1947, 875 patients had been included in the study, but 29% of these had had to be excluded because they were unable to follow the instructions given or to keep reliable dietary records. *R. L. Hartley*

Maternal Mortality in Clinical Obstetrics; Causes and Dependence on Circumstances of the Time. (Müttersterblichkeit bei klinischer Geburtshilfe, ihre Ursachen und ihre Abhängigkeit von den Zeitumstanden.) WOLFHAGEN, O. (1948), *Z. Geburtsh. Gynäk.*, **129**, 242.

The author differentiates primary clinical deliveries from secondary clinical deliveries. In primary delivery there was no antenatal care or treatment, while in secondary delivery there had been either previous examination or treatment. Amongst 42,858 deliveries between 1915 and 1946 at the University Clinic for Women, Hamburg, there were 228 maternal deaths, 153 directly due to pregnancy and 73 due to associated causes. Of 161 deaths, 69 were primary, 92 secondary, 53 due to eclampsia, 19 due to placenta praevia, three due to accidental haemorrhage, and seven due to rupture of the uterus.

A definite decline in the death rate from puerperal

sepsis was noted. This was independent of war conditions. Embolism showed decrease during the war period 1914-21 and an increase during peacetime. The decline in number of cases of embolism was thought to be due to a decrease in obesity. The fluctuations in number of cases of post-partum haemorrhage showed no relation to peace or war, but the amount of blood lost was greater during wartime and thus the number of deaths due to this cause increased. This was thought to be a consequence of changes in the autonomic nervous system due to mental and material stress. The number of cases of obstetric shock showed no relation to war or peace.

J. Tintner

The Biological and Clinical Significance of the Early Onset of Menstruation. The Acceleration of Development of the Young in the Pre-war Era. (Die biologische und klinische Bedeutung des frühen Menarchetermines. Zur Entwicklungsbeschleunigung der Jugend in der Vorkriegszeit.) TIETZE, K. (1949). *Z. Geburtsh. Gynäk.*, **130,** 273.

The author has made an extensive study of the biological and clinical significance of the early onset of menstruation in adolescence. He comes to the conclusion that the accelerated development of the young generation, shown by the advance of menarche from an average of 14·5 to 15 years at the beginning of the century to an average of 14 years now, may almost be spoken of as an evolutionary phenomenon. The author thinks that it is of an endogenous character and that it varies exogenously. Clinical tests have failed to elicit any proof that early menarche—at least in so far as the functional efficiency of the female is concerned—results in increased morbidity. Nor is there any good reason to consider the advance of menarche an unfavourable biological variant.

The results of accelerated development lie in a different sphere altogether. The period between the onset of puberty and the average age of marriage is prolonged; the sexual functions are active in girls hardly out of childhood, so that they are made to realize the facts of life and must adapt themselves to them often much sooner than is desirable. This may lead to far-reaching consequences, and it is the task of the parents and of the educationists to give guidance. The entire problem of accelerated development of youth and all other problems connected with it demand attention, more especially in view of the significance of the accompanying circumstances, mainly of a psychological and sociological nature; they are thus out of the sphere of activity of the physician, who merely plays the part of an adviser to parents, educationists, and magistrates at juvenile courts.

I. Bierer

Erythroblastosis Fetalis in Negroid Infants. WIENER, A. S., and WEXLER, I. B. (1948). *Blood*, **3,** 414.

The incidence of erythroblastosis foetalis among Caucasoid populations is believed to be between 1 in 400 and 1 in 150 births. If the Rh factor were of equal importance in the aetiology of erythroblastosis in the two ethnological types, it might be expected that the incidence of the condition among negroes would be from one-third to two-thirds of that found in Caucasoids. In fact, however, erythroblastosis is rare in negroid infants. The authors present clinical and haematological histories of three such infants, on whom a diagnosis of erythroblastosis foetalis was made. In two of these cases the condition was proved to be due to sensitization of the mother to A and B factors, while in the third instance no isosensitization of the parent by an antigen in the foetal blood could be demonstrated. Rh sensitization was not present in any of the cases reported. The suggestion is made that in the negroid races either the placenta offers a more complete barrier to the passage of materials from foetus to mother, or susceptibility to sensitization with antigens of foetal origin is low in these peoples.

H. Payling Wright

Results of the Nationwide Study of Penicillin in Early Syphilis. (A Report of the Central Statistical Unit.) I. Amorphous Penicillin in Aqueous Solution. MERRELL, M. (1949). *Amer. J. Syph.*, **33,** 12.

Approximately 7,000 patients are included in this analysis. Seven treatment schemes, with doses of 300,000 to 800,000 units of penicillin, were used. In the majority of cases the drug was given 3-hourly over 7·5 days. About a year after treatment at least 10% of patients had a clinical relapse or re-infection. At 15 months the patients treated with the lower dosage of penicillin showed a clinical relapse rate of up to 25%, whereas the highest doses used yielded a 12% relapse rate. It is noted that the clinical relapse rate was steadily rising over the entire period of observation, but the author has not attempted to exclude re-infections. The total failure rates, which included both clinical and serological failures, were 1·5 times as large as the corresponding rates based on clinical failures only. It is concluded that even of the earliest cases of syphilis treated with the highest dosage schedules 10% will relapse at the end of the first year.

G. W. Csonka

II. Amorphous Penicillin versus Crystalline Penicillin G, and Aqueous Penicillin versus Penicillin—Oil—Beeswax. RIDER, R. V. (1949). *Amer. J. Syph.*, **33,** 19.

When treatment by amorphous penicillin was compared with that by crystalline penicillin G no significant difference in the number of clinical relapses was found, but when serum resistance and serum relapses were taken into consideration as well the results obtained from crystalline penicillin G appeared to be superior at the end of the observation time of 14 months. The doses employed were 2,400,000 or 4,800,000 units over a 7½-day period, injections being given 2- to 3-hourly. There was, however, no difference, so far as results were concerned, between 2,400,000 and 4,800,000 units of G, or the 2- and 3-hourly intervals between injections. In comparing penicillin in peanut-oil-beeswax and penicillin in aqueous solutions two series were used—one with 4,800,000 units, the other with 9,600,000 units. No difference in failure rate was observed between the two drugs in either series. This bears out the earlier favourable results recorded with penicillin in oil-beeswax.

[This and the previous paper give important statistical evidence of the value of penicillin as a sole agent in the treatment of early syphilis, and for details the original papers should be consulted. As the treatment "failures" include an unknown number of re-infections, the true picture may be more favourable.] *G. W. Csonka*

Penicillin Syphilotherapy Administered Prior to Pregnancy. A Study of 111 Pregnancies during which Additional Antisyphilitic Treatment was Withheld. TUCKER, H. A. (1949). *Amer. J. Syph.*, **33,** 1.

The author reports 111 pregnancies in 88 women in which no treatment of syphilis was given during pregnancy: 72 of the patients had primary or secondary syphilis, and of the remainder latent or early asymptomatic neurosyphilis. The majority received 3,000,000

units of aqueous penicillin every 2 or 3 hours for 7½ to 15 days. At the time of delivery 30 mothers were serum-positive. There was only one congenitally syphilitic child born, giving an incidence of 0·9%. It is concluded that giving penicillin in excess of 2,400,000 units to a syphilitic woman, whether pregnant or not, with satisfactory response, is sufficient to guarantee healthy offspring in subsequent pregnancies, provided relapse or reinfection does not occur. Each patient should be observed monthly throughout every pregnancy, in order that re-treatment may be given promptly in the event of a positive serum reaction, serum resistance in high titre, clinical relapse, or reinfection. In the author's experience the incidence of infantile congenital syphilis has already been reduced to a fraction of that seen before the advent of penicillin.

[It is open to question whether re-treatment should be withheld at a stage of syphilis when the relapse rate after optimum treatment may be as high as 10%.]

G. W. Csonka

Forecasting the Incidence of Neurosis in Officers of the Army and Navy. MAYER-GROSS, W., MOORE, J. N. P., and SLATER, P. (1949). *J. ment. Sci.*, **95**, 80.

An attempt was made at Crichton Royal, Dumfries, to assess the reliability of 16 different pointers in forecasting the incidence of neurosis in officers of the Army and Navy. These pointers were: heredity, previous ill-health, neurotic traits in childhood, former psychiatric illnesses, defective intelligence, adolescent shyness, adult shyness, temperamental instability, obsessional features, apprehensiveness, undue dependence in childhood or later life, unstable work record, sexual difficulties, alcoholism, head injuries, and accident proneness. The cases investigated comprised 101 naval officers, 100 army officers, and 55 " normal " controls from a mobile army division. The average numbers of pointers in the various groups were : naval neurotics 4·50 (range 0 to 10), army neurotics 5·96 (range 0 to 12), and controls 0·93 (range 1 to 7). The authors prefer not to express any opinion on the causes for the discrepancy between the figures for the army group and those for the naval group. Discharged neurotic patients had a significantly higher average number of pointers than those retained in the Service (6·92 and 5·34 respectively). By a specially adapted method of factor analysis, combinations of pointers were studied and 3 main divisions separated off, a main class indicative of inadequacy, a second class indicative of instability, and a third class indicative of shyness.

D. S. Fairweather

Morale and Flying Experience: Results of a Wartime Study. STAFFORD-CLARK, D. (1949). *J. ment. Sci.*, **95**, 10.

" Flying stress " became as ambiguous a phrase as " shell shock " and " D.A.H ". Symonds established its permissible use as a description of the stresses to which the flying man is liable rather than of the reactions which he shows.

The present author describes the particular nature of the stresses involved by the operations of Bomber Command. Most lucidly does he show how morale was built up, and graphically records what might be termed the " normal " reactions to stress before discussing the more abnormal aspects. As against a casualty rate for killed and missing of about 48%, and one for killed, missing, wounded and injured of about 64%, the rate of " nervous breakdown " was less than 5%. This is indicative of the extraordinarily high level of morale. Breakdown might or might not be complex, involving domestic problems, financial anxiety, or worries relating to parents, but of supreme importance were the physical realities of violent death.

The conflict between the sense of duty and the instinct of self-preservation was clear. The physician's duty involved consideration not merely of the patient's welfare, but also of repercussions on the morale of the unit. Four main types of breakdown occurred: (A) at the beginning of bomber operations; (B) in the middle ; (C) in the last four or five sorties; and (D) as the result of exceptional stress. Prognosis was worst in the first and fourth types. The main characteristics of each group may be summarized as follows: (A) essentially unwilling to fly, anxiety states predominating; (B) developing symptoms, especially anxiety, after the eighth or ninth operational sortie, and in need of reinforcement of resolution; (C) developing symptoms due to fatigue and anxiety, showing temperamental lability, and in need of adequate rest and change; (D) after a single appalling experience, accompanied by horror and great distress, in need of sound sleep and continuous unobtrusive supervision.

The 46 cases studied are classified as cases of anxiety (31), hysteria (5), depression (4), fatigue (2), and loss of confidence (non-medical). The figures are comparable to those given by Symonds and Williams (F.P.R.C. 412 (9) included in Air Publication 3139, H.M.S.O.) in an analysis of 1,197 similar cases. A graph is drawn to illustrate successive fluctuations in the morale of normal men.

D. S. Fairweather

Cardiovascular Rejectees. A Follow-up Study. WHITE, P. D., LEVY, R. L., KERR, W. J., STROUD, W. D., and FENN, G. K. (1949). *J. Amer. med. Ass.*, **139**, 1049.

Re-examination in 1943 of 4,994 men previously disqualified by local boards from general military service in the U.S. armed forces because of suspected cardiovascular defects enabled 863 to be regraded as fit for service, 447 of whom were accepted. The chief diagnostic difficulties arising at that time lay in the interpretation and assessment of apical systolic murmurs, in the definition of the limits of normal blood pressure, resting pulse rate, and heart size in relation to body build, and in the evaluation of results of exercise tests and electrocardiographic findings, while there was some doubt as to the desirability of rejecting men with a diagnosis of neurocirculatory asthenia, or a history of recent rheumatic fever without evidence of cardiac disease. The present (1947) follow-up study of 303 of those men who had been regraded as 1A in 1943 was carried out in order to assess the effects both of the war and of post-war adjustment on their cardiac condition.

At least 50% still had trivial heart murmurs; four had developed rheumatic heart disease since 1943, but in those who gave a history of rheumatic fever in childhood or early life without demonstrable sequelae in 1943, " recurrence of activity between 1943 and 1947 was distinctly uncommon." There were no significant changes in heart size, with the exception of four men who had developed definite enlargement, one of whom was hypertensive, the others apparently healthy. Of 67 men with transient hypertension at their first examination, 33 now had normal readings, 17 still showed transient hypertension, and 17 had developed sustained hypertension. Another ten, whose blood pressure was normal

in 1943, now had sustained hypertension, and 13 had developed transient hypertension. No conclusions could be drawn from analysis of the pulse rates. The electrocardiogram had become abnormal after 4 years in only one case, and seven men were thought in 1947 to have neurocirculatory asthenia which had not been diagnosed in 1943. The authors conclude that these 303 men, in general, " served long and well in the Armed Forces," and few were discharged for cardiovascular reasons.

J. L. Lovibond

Some Public Health Problems in Nuclear Fission Operations. GORMAN, A. E., and WOLMAN, A. (1949). *Amer. J. publ. Hlth*, **39**, 443.

The United States Atomic Energy Project, which has grown so enormously in such a short time, has created sanitation problems of immense importance to public health. These problems are such that well-established hygienic principles are applicable only up to a point; many new lines of approach had to be sought. New methods have been evolved to protect the health, not only of very considerable numbers of people engaged on the project, but also of the general public. The impact of this new industry will undoubtedly be felt by whole nations.

This paper is a broad appraisal of the health implications of nuclear fission and its sequelae. It embodies a clear exposition, in non-technical language, of the facts relating to the project. Emphasis is laid upon the need which now exists for training sanitation workers in these new aspects of their task. Large communities of people have been gathered into formerly sparsely inhabited regions. Thus, at the outset, a formidable problem in housing, drainage, sanitation, and water supply is presented, and to this must be added the effect of building large chemical and engineering plant of great complexity and novel design. The processing of uranium on a vast scale involves new industrial health hazards because of radioactivity, at the same time creating grave problems of effluent disposal. The uranium pile itself is an entirely new type of plant in which a nuclear " chain reaction " is maintained. Radiations of unprecedented intensity are evolved in the process, and the end-product is plutonium, a dangerously radioactive metal, recently created and not found in nature. Intermediate " fission products", highly radioactive and often gaseous in form, demand disposal. A water-cooled pile requires enormous quantities of water, and its effluent is heavily contaminated with radioactive substances. Similarly, an air-cooled pile contaminates great volumes of air, thus creating a serious problem requiring the co-operation of meteorologists. Pile operatives have to be highly trained, carefully protected by shielding and remote-control devices, and kept under strict medical surveillance. The new science of health physics has rapidly reached a high degree of specialization. " Monitors " use electrical counting and measuring instruments to estimate radiation, and their task is to restrict the exposure of personnel to within various tolerance limits laid down by research workers. The manufacture of radioactive isotopes is no mere scientific curiosity but is a growing commercial concern; their applications in industry are even wider than in medicine.

Atomic energy and its implications must now be considered in any large-scale public health plan. The hazards of radioactivity will eventually command almost as much attention as those of infection, and must be included in the province of the sanitary engineer and public health expert.

T. E. Graham

A Nutritional Survey in Pregnancy with Particular Reference to Certain Haematological and Biochemical Findings. HOBSON, W., LEWIS, F. J. W., and WOODMAN, D. (1949). *J. Obstet. Gynaec. Brit. Emp.*, **56**, 217.

This survey was carried out in Bristol on a large group of primiparae by means of the " individual weighing method", which gives information of the mean minimum and maximum intake of every article of diet and of its every chemical constituent. The findings were correlated with the subsequent clinical history.

No correlations were found between protein intake or quality of the diet and serum protein level; between calorie intake, protein intake, or quality of the diet and the birth weight of the baby; between iron intake and haemoglobin level; or between serum protein level and birth weight or incidence of toxaemia. The diet in the group was better than before the war. Thus the mean intake of protein was 90 g. per day, or 1·5 g. per kg. body weight. In terms of animal protein the diet was also better than the pre-war diet, the mean value being 50 g. as compared with 43 g. found by McCance, Widdowson, and Verdon Roe (*J. Hyg., Camb.*, 1938, **38**, 596). The mean dietary intake of iron was 14 mg. per day, compared with 12 mg. in 1938 (McCance and others), and there was no evidence of iron deficiency in the group as a whole. The authors attribute these improvements to the fall in unemployment from 1939 onwards, the introduction of National flour in 1942, and the various diet priority schemes for expectant mothers introduced from 1941 onwards.

F. J. Browne

Prenatal Maternal Factors in Mongolism. BENDA, C. E. (1949). *J. Amer. med. Ass.*, **139**, 979.

Two previous studies, of 250 and 75 cases of mongolism, have been published and this report deals with a further 50 cases tabulated according to maternal age, the latter ranging from 52 to 21. It is maintained that mongolism increases with advancing maternal age, and that the mongoloid child is found near the end of a line of siblings. Two or more mongoloids are found only in families of over six children. The theory that mongolism develops from fertilization of an " over-aged " ovum cannot be excluded, though later extrinsic factors seem of more importance. A threshold condition of hormonal sterility exists, in which the maternal organism is unable to produce the proper endocrine environment for the embryo. This may be due to an approaching menopause, or to insufficient response to fertilization in women under 30 years, or in primiparae. In addition, intercurrent illness may render the mother unfit for pregnancy.

Examination of the three maternal age-groups (21 to 30, 31 to 40, 41 to 52) shows that certain recurrent contributory factors slow down the growth rate, making the mongoloid infant physiologically immature, and " ill-finished." In the highest age-group pregnancy occurred at or near the menopause, with a long interval since the last pregnancy; this points to involution of the ovary and uterine mucosa. Thirteen mothers in this group were mentally sound and of superior type, and had given birth to 43 living children. In the middle group fertilization was slow (from 5 to 12 years) and after this in 48% of the cases the first child was mongoloid. Continued menstruation or threatened abortion during pregnancy was common, with a high incidence of menstrual irregularity before pregnancy, and a history of thyroid disorder. The latter was so common in this group that it is suggested that in areas in which thyroid

disorders are prevalent there should be an increase in mongoloid births. This suggestion is supported by the findings of Myers (Toronto). In the youngest age-group there was a high percentage of thyroid disorder and slow fertilization time, together with cases in which bleeding during pregnancy or previous abortion had occurred.

The conclusion drawn is that genetic factors are not responsible, but that there exists a constellation of factors contributing to a deceleration of developmental rate early in gestation. It is suggested that, in order to counter this effect, treatment must start as early as possible. *C. S. Nicholson*

Infant Mortality. MARTIN, W. J. (1949), *Brit. med. J.*, **1**, 438.

The author, working in the Statistical Research Unit of the Medical Research Council, has reviewed the course of infant mortality in England and Wales during the present century from data tabulated in official statistics.

The infant mortality rate was 154 per 1,000 live births in 1900 and 41 in 1947. When the observed rates for the period 1900-47 are plotted as smoothed values on a simple exponential curve the average annual rate of decline is 2·58%. From the trend of this curve there is no evidence to support a claim that there has been an exceptional decline in mortality in the past year or two. It is suggested that the rate will continue to decline for some years even if no new advances in infant care are made.

Since 1911 it has been shown that the decline in mortality rate has been greater in the urban than in the rural districts. In that year the mortality rate progressively increased from south to north of the country, and this discrepancy is still evident. The decline in rate has been greater among girls than among boys, the annual average rates of decrease being 2·6 and 2·49% respectively.

For all causes of death during the first year of life the probability of dying decreases with increasing age. Efforts to reduce infant mortality have been more successful in the later periods of the first year of life than in the earlier periods. At the present time roughly 40% of ali infant deaths occur in the first week of life; this is twice the proportion of 40 years ago. The greatest decline in the mortality has been at ages 9-12 months—from one-eighth to one-twentieth of all infant deaths. It appears from the decline in mortality in the age period 3-12 months that the curves are becoming asymptotic, so that there is no evidence that there will be much further improvement in the rates at these ages.

The seasonal distribution of infant deaths has completely changed. In 1900 the highest rate was in the September quarter, but this quarter now has the lowest rate. There are no adequate data to explain this, although the diminution in summer diarrhoea is responsible for part of the decline.

Analysis of the diseases responsible for the fall is difficult because of the many changes in classification in the past 50 years. From a study of the rates for quinquennial periods the following conclusions may be drawn. There has been a large improvement in the mortality from measles, whooping-cough, all forms of tuberculosis, bronchitis, and convulsions. Mortality from convulsions shows the most spectacular fall—from 14·59 in 1901-05 to 0·83 in 1941-45. The fall in the pneumonia death rate has been small—11·38 in 1901-05 to 8·08 in 1941-45. Mortality from prematurity and from diarrhoea and enteritis has been almost halved in the period, but both are still very important causes of death: in 1945 prematurity accounted for 24% of the total infant mortality, diarrhoea and enteritis for 11%. Exceptions to the general decline are the rates for congenital malformations and injury at birth. Some of the increase in death rate from congenital malformations and from birth injury may be due to the larger proportion of first births. The probability of congenital deformity increases with increasing maternal age, so that from the trend of the birth rate a decrease in congenital defects would have to be expected. *L. M. Rose*

A Study of Tuberculosis Mortality in England and Wales. STOCKS, P. (1949). *Tubercle*, **30**, 50.

Within the last 75 years in England and Wales tuberculosis mortality has shown a definite trend to reduction; it can be said that the percentage reduction in mortality in a unit of time is constantly increasing in spite of the setbacks attributable to wars.

Age and sex have an influence on mortality. Mortality from respiratory tuberculosis in children under the age of 5 seemed to fall rather rapidly till 1939; since the war, however, it remains on a higher level in the male group and has hardly fallen at all in girls of the same age. Among persons between 55 and 75 years old there is very little reduction in mortality since 1939. The cause of this is uncertain, though there is a faint suggestion that better diagnosis has brought into the tuberculosis group the cases which would previously have been treated as "chronic bronchitis."

If the population under study is divided into two groups, one between the ages of 15 and 45 and the second between the ages of 45 and 65, for males and females separately, the regional differences are demonstrated. Thus the highest mortality in the younger male group is in the eastern part of South Wales and the county of Durham, and in the older group in Greater London and Cheshire, together with the western part of Lancashire. Among females the highest mortality in the younger group is found in the eastern part of Wales and in the northern part of England, and the older female group in the county of Durham and in Wales. The significance of morbidity statistics is stressed.

Taking into consideration the interrelation of tuberculosis mortality and life expectation, tuberculosis should be considered a most important problem, because its eradication would bring the community much more good than that of any other disease. *E. W. Collis*

Tuberculosis Survey of a Suspected School Group. ROE, J. T. N., and DICK, W. P. (1949). *Tubercle*, **30**, 39.

The finding that among the patients under the care of the Uxbridge Chest Clinic 5 pupils suffering from tuberculosis were at a local technical school led to a fluorographic survey of all the 342 pupils, aged 13 to 17, and the staff (33) of the school; 327 pupils and 18 of the 19 masters were examined but none of the 8 domestic staff would submit to the examination. A tuberculin jelly test was carried out at the time of fluorography. As a result of the survey a further 7 cases of pulmonary tuberculosis were found. Of these 6 were in scholars aged 15 or over and one was in a master. In the two classes in which an open case was found the average proportion of positive reactors was 57%, in the 3 classes in which there were only sputum-negative cases it was 43%, and in the 2 classes of comparable age group with no

cases of tuberculosis the proportion was 38%. The literature on school surveys is reviewed and the 13 cases of tuberculous lesions are described. These may be summarized as 4 cases of primary pulmonary tuberculosis, 3 of which were open cases, 4 cases of pleurisy with effusion, and 5 cases of post-primary tuberculosis, one of which was an open case. The possibilities of contact infection amongst the boys themselves and also of infection by members of the staff are discussed, but final conclusions cannot be drawn owing to the lack of co-operation on the part of the domestic staff and one master.

Among the forms in which an open case of pulmonary tuberculosis was found there were approximately twice the usual number of positive tuberculin reactors for that particular age group. The proportion of cases among the 71 positive reactors in the affected forms was equivalent to 155 per 1,000, a distinctly high figure. No outside source of infection could be found and only in one case was there any family susceptibility.

Although no definite conclusions can be drawn from this survey it is of considerable value in that it indicates that the presence of a case or cases of open tuberculosis in a day school resulted in an incidence of contact infection equal to six times that considered normal for similar age groups. The survey also emphasizes the importance of tuberculin testing and mass radiography of scholars within the 13 to 17 age group, and the search for sources of infection where the survey reveals a higher percentage of positive reactors than is considered normal. *Frederick Heaf*

Survey of a Scottish Diabetic Clinic. A Study of the Etiology of Diabetes Mellitus. MUNRO, H. N., EATON, J. C., and GLEN, A. (1949). *J. clin. Endocrinol.*, **9**, 48.

This is a statistical study based on the clinical records of 1,309 diabetics seen in the out-patient department and wards of a Glasgow hospital during 1932-42. These are considered to be representative of Scottish diabetics.

Diabetes was found to be much more common in middle life. At this stage (after 40), it is more common in women, and particularly so in those with large families, than in a similar group of unmarried women and in men. The incidence in the latter two groups is equal. Further, up to the age of 40 years, the incidence in men and women is equal, and women out-number men by 2·6 to 1 after this age. Of 923 diabetics 23·2% gave a family history of the disease, though only 5·3% of 2,043 non-diabetic people gave such a history. A positive family history was less frequently obtained in diabetic women with large families. The incidence in women thus appears to be at least partly related to previous childbearing. A history of previous obesity is obtained more frequently in diabetics than in controls, but this could not be correlated with the greater incidence of the disease in married women. Hypertension is commoner in diabetic women than in men or a similar group of non-diabetic women. This is not related to weight or child-bearing. Thirteen patients, or 1%, had associated thyrotoxicosis. In these the age of onset of the diabetes approximated to the age of onset in non-thyrotoxic diabetic patients rather than to that in non-diabetic thyrotoxic subjects; the incidence of a family history of diabetes in this group corresponded to that in all diabetic cases.

It is tentatively suggested that heredity is " fundamental to virtually all cases " and that in such cases obesity, child-bearing, thyrotoxicosis, acromegaly, and sepsis may act " by increasing the susceptibility ". *I. Grayce*

Incidence of Diabetes Mellitus in Children and Need for Hostels. HENDERSON, P. (1949). *Brit. med. J.*, **1**, 478.

A numerical investigation of the number of diabetic school-children in Britain has been undertaken by the Ministry of Education. The result suggests that there are 1,200 such children in England and Wales, of whom 130 require education in an institution because their parents and home conditions make their lives impossible. Since 1939 the London County Council has looked after some 60 to 80 such children in Essex, with such good results that they have grown up into useful adults. More hostels for such children are now being established by the Church of England and other voluntary bodies and it appears that adequate provision will soon be available all over the country. [No mention is made of the Diabetic Association which really initiated this movement.] *R. D. Lawrence*

Clinical and Social Problems of Epilepsy. Parts I and II. NATTRASS, F. J. (1949). *Brit. med. J.*, **1**, 1, 43.

After reviewing the historical background, the author starts by considering the clinical problems of epilepsy, including the phenomena of local epilepsy, major seizures, petit mal, release phenomena, myoclonus, and status epilepticus. He continues with a discussion of diagnosis, in which he considers that there is little to be gained from stressing the questionable relationship between epilepsy and other paroxysmal disorders, such as faints, vaso-vagal attack, laryngeal "epilepsy", narcolepsy, vertigo, and migraine, from which true epilepsy should be firmly differentiated.

In dealing with the causes of epilepsy, the author presents an analysis of the age of onset in 991 cases, in 12% of which it was between 31 and 40 years, and in 17% over 40. Comparing these figures with those of earlier series, he claims that, drawn as they are from private practice and the out-patient department of a general hospital, they give a truer picture than those derived from institutions or special hospitals. Of 100 patients with epilepsy starting after the age of 40, whom he has followed up for 3 years or more, 25 have died (10 from cerebral tumour, 5 from cerebral vascular disease), but the surviving 75 show no sign of intracranial tumour. Moreover, of 200 patients with cerebral tumour, only 28% had fits at any time, and only 19% began with fits, other signs developing within a year in one-half of these. In view of these findings, the author believes that in the majority of cases epilepsy —at whatever age it starts—is idiopathic.

He concludes with a review of the social problems of epilepsy, stressing the importance of allaying the excessive fears of parents and urging that epileptic children should stay at school if at all possible, and that infrequent attacks should seldom be held to prevent a young man from adopting the occupation of his choice.

[This is an excellent short review of the subject.] *N. S. Alcock*

Sickness Absence due to Peptic Ulcers. DOLL, R., and BUCKATSZCH, M. M. (1949). *Brit. J. industr. Med.*, **6**, 100.

The sickness absence of men with peptic ulcers was determined among 2,871 employees of seven firms, six in London and one in a small provincial town, and compared with that of controls of the same age and similarly

employed. Of all employees 5·4% had been shown to have a peptic ulcer and their mean sickness absence was 6 working days a year more than that of controls. Thus it is calculated that 32·4 working days a year per hundred men are lost as a result of peptic ulcer. *C. Bruce Perry*

Poliomyelitis and the Social Environment. HILL, A. B., and MARTIN, W. J. (1949). *Brit. med. J.*, **2**, 357.

It has been suggested that towns with favourable health conditions as revealed by low infant and general mortality rates are peculiarly liable to a heavy incidence of poliomyelitis when that disease becomes epidemic. The recorded notifications of poliomyelitis in the 273 large and small towns of England and Wales show no such association between the attack rates they suffered in the 1947 epidemic and the infant and general death rate they experienced in the two preceding years, 1945-46. In other words, according to this experience, favourable mortality rates, indicating social conditions in a locality, need not raise fears of an unduly heavy risk when poliomyelitis becomes widespread.—[Authors' summary.]

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